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Joseph Hume Esq.r M.P.
for the Montrose District of Burghs.

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THE GLASGOW

MECHANICS' MAGAZINE;

AND

ANNALS OF PHILOSOPHY.

VOL. IV.

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MEMOIR

OF

JOSEPH HUME, Esq. M. P.

WRITTEN FOR

THE GLASGOW MECHANICS' MAGAZINE,

BY

ONE OF HIS SCHOOL-FELLOWS.

THE subject of this memoir is an instructive example of what a man is capable of achieving for himself and for his country, though commencing life with few of what the world denominates advantages; and he is a no less memorable example of the importance of an early impression deeply stamped, both by precept and example, that for success in life a man should place his dependence upon himself, and look to his own exertions, prudently directed, perseveringly maintained, and honourably planned and conducted.

Mr. Hume was born in Montrose, in the year 1777, of parents in the middle, or perhaps only approaching the middle rank of life, his father being the master, or captain, of a trading vessel belonging to that port. He died when the subject of this memoir was still young, leaving a considerable family to the charge of his widow—a woman of extraordinary merit, who, by the business of a shop, to which a small capital was equal, enabled herself to rear her children; to give them an education not inferior to what was given to the better sort of inhabitants in the place; and by the influence of her own character, her example, and her precepts, to lay the foundation of such a mind as that which has developed itself in the son whose life we are now shortly recording.

With an original education, which extended not beyond the schools of his native town, reading, writing, accounts, and an elementary knowledge of Latin, Mr. Hume, as intended for the medical profession, was entered as apprentice with one of the surgeons of the place, and served with him for three years. He attended the medical classes in the University of Edinburgh during the years 1793, 1794, and 1795; and in this last year was admitted a member of the College of Surgeons in Edinburgh. He made a voyage to India in 1796; and in 1797, after attending the hospitals, he was admitted a member of the College of Surgeons in London.

After four years in the medical department of the East India Company's naval service, he proceeded in 1799 to Bengal, on the company's medical establishment, under that presidency; and here those energies, which have been so well displayed in his subsequent career, found scope for their operation. At that time the labour of acquiring the native languages was rarely submitted to by the company's servants. The good sense of Mr. Hume made him easily perceive to how great a degree a man must be enabled to render himself more useful in India, with than without a knowledge of the dialects of the country; and his early habit of looking to labour, not with terror, but with complacency, as the grand instrument of all the good he was to produce for himself, made him, without hesitation, apply himself with assiduity to effect the important acquisition.

When the company's army took the field in 1803, in the war with the Mahrattas, Mr. Hume was attached to that division which marched from Allahabad into Bundelcund, under the command of Major-General Powell. Here he immediately experienced the effects of that foresight which had led him to acquire the languages of the country. An interpreter was required for the assistance of the commanding officer. He was selected for that important service. The offices of paymaster and postmaster of the troops were such as would best be filled by a man who was capable of holding direct communication with the natives. Mr. Hume continued his medical duties, and also discharged the duties of both these offices; and was at times appointed to other duties, which the commanding officer, by experience of his services, was led to regard him as peculiarly qualified to discharge.

During the whole of the time which the army was in the field, Mr. Hume, by powers of application to which few men are equal, was enabled to unite in his own person a variety of offices, which yielded both honour and considerable emoluments. On the conclusion of peace in the year 1807–8, he returned to the presidency; and soon after, on account of his private affairs, proceeded to England.

Up to this period, his professional studies, and the incessant employment of Mr. Hume, in the various services to which he had been called, had denied him the opportunity of supplying the defects of an early interrupted education.

It is one of the enviable peculiarities of Mr. Hume, rare as it is valuable, that he never disguises from himself a defect of his knowledge, nor seeks to disguise it from others.

Fully aware of the extent of information which it yet remained for him to acquire, and with a correct estimate of its value, he lost no time in acquainting himself with the objects to which it was of most importance for him to direct his attention; and proceeded in the acquisition of knowledge with the same industry which had led to success in the previous pursuits of his life.

With habits of mind which led him to direct a particular share of his attention to facts, he visited, in 1809, every place of manufacturing celebrity in England, Scotland, and Ireland; and made a tour of minute observation through the united empire.

The greater part of the years 1810 and 1811, he spent in travels in Spain and Portugal, in Turkey, Greece, Egypt, the Ionian Islands, Sicily, Malta, Sardinia, &c.; and on his return to England he was elected to serve in parliament for the borough of Weymouth, on the death of Sir John Johnstone, and sat during the session of 1812.

One of the most remarkable subjects which occupied the attention of parliament during that session, was the frame-work knitters' bill, urged forward with short-sighted impetuosity by the workmen in Leicester and Nottingham. Mr. Hume opposed this bill. He was indeed the main cause of throwing it out; and was distinguished by the thanks of the manufacturers for his exertions.

A reference to the proceedings of that day when the Luddites were the terror of Leicester and Nottinghamshire, show that Mr. Hume, though a young member of the House of Commons, opposed himself to the unreasonable and mischievous conduct of the workmen. It was against sound principle that the workmen wished to fetter the conduct of their masters by the bill which the members for Nottingham were obliged to bring in; and Mr. Hume opposed their wishes with as much zeal, and with like success, to set the masters free, as he afterwards opposed himself to the prejudices of the masters, and effected the repeal of the Combination Laws, to set the workmen free. A reference to the resolutions of the master manufacturers of Leicester and Nottingham at that time, will best explain their sense of Mr. Hume's services.

Mr. Hume, having arrived from India with strong impressions in favour of the government as it stood, and as it was administered, and against all those who found in it any thing to blame, took his seat on the ministerial side of the house; but as he was a man who did not shut his eyes, or resist conviction, his opinions and proceedings, in the active part which he took in commercial questions, gave so little satisfaction, that the trustees of Sir John Johnstone declined to return him for the new parliament; and, according to report, forgot engagements into which they had entered.

It comes within our knowledge, that seats more than one were at the acceptance of Mr. Hume at the general election in 1812, could he have submitted to the engagements customary on such occasions. Resolving to be independent, he declined them.

Though not in parliament, Mr. Hume was not a passive spectator of public wants; and he was an active instrument in some of the most important undertakings of the subsequent years.

No exertions in our time, perhaps, are more memorable, or greater in their consequences, than those which were at that time set on foot by a few private and meritorious individuals, for extending the benefits of education to the great body of the people; we mean the exertions which were made for multiplying Lancasterian Schools. Few men were more active in their endeavours to second the efforts of the original promoters of this great work than Mr. Hume; and he continued an assiduous member of the central committee in the borough road, till it was placed on a basis which could not be shaken.

Another scheme for the benefit of the working classes, second in importance to their education alone, was then agitated; a scheme for affording them the means to benefit by savings—and a motive to make them. Mr. Hume was among the first to lend himself to this undertaking; and in a pamphlet which he published at an early period of the business, recommended the plan for saving banks, which was subsequently adopted.

It was during this time also, that Mr. Hume began those exertions in the court of East India proprietors, which he has so perseveringly continued. During the discussions respecting the renewal of the company's charter, he afforded a specimen of the courage which he has since so amply displayed, in facing unmoved an overwhelming majority, assailing him for adherence to what he held to be right; when, in 1813, he stood alone contending in the court of proprietors for freedom of trade, against the friends of monopoly. The various occasions on which he has thus been the advocate of liberal and enlightened principles, and the enemy of narrow and corrupt policy in its various shapes, are far too many to be enumerated on this occasion.

In the year 1818, Mr. Hume again appeared in parliament; having been chosen at the general election, by his native town of Montrose, by Brechin and Arbroath, three out of the five which compose the district of boroughs, in opposition to Mr. James Farquhar, who holds a sort of family property in Aberdeen and Bervie, which are the remaining two. He was also re-elected in 1819, after a severe struggle, the first, perhaps, in which the body of the people in these boroughs took any share.

For his public services since that period, we may appeal to the recollection of our readers. They will never be forgotten in the annals of his country. We have not space to enter into details; but we cannot deny ourselves the pleasure of tracing shortly their general character.

Every proposal of any measure calculated for the amelioration of our institutions, and more especially for raising the consequence of the people, and giving efficacy to the check which they hold for the prevention of bad government, has found in Mr. Hume a decided and persevering advocate. Reform in parliament, the liberty of the press, and unlimited toleration, are indebted to him for the most strenuous support. On the last point, his conduct is the more meritorious, as it has the fewer imitators, and is the more exposed to be misunderstood, and rendered the subject of vulgar detraction. In presenting the petition of Mr. Carlisle, for that deliverance which ministers themselves have at last thought proper to grant him, from a state of cruel punishment, inflicted on him for the exercise of that freedom of forming and delivering opinions on the subject of religion, which can be denied to no man consistently, without bending to the most frightful consequences, he, and the never-to-be-forgotten Ricardo, joined in a declaration which was new to the ears of an intolerant parliament, and which was made the subject of an ignorant clamour against them both. That there is no consistency nor fairness in toleration, unless it is all comprehensive; that if a license is extended to one or more sets of men to deliver their opinions, whilst permission to do so is taken away from others—this is privilege, not freedom; it is monopoly, not equal dealing; it is not liberty of conscience, but licensing of conscience; and is equally at variance with true religion, and with solid reason.

The line of exertion, however, which Mr. Hume has more particularly selected for himself in parliament, is one in which he was peculiarly qualified to render the greatest service to his country—that of exploring, exposing, and denouncing the wasteful expenditure of the government; and that not merely in general declarations, but by tracing the different streams of profusion to their source—and by fixing upon them the attention of the nation—forcing a better economy upon parliament and ministers themselves. Considering all the disadvantages under which Mr. Hume began this career, the union of all parties to bear down a man who stood aloof from all parties, the offensiveness of the task which he had to perform, as a man who was but just entering upon public life, and had yet to learn of the art of addressing a public assembly, it is not a little surprising to observe the progress which he has made; not merely the sums which he has been the means of saving to the nation, but the attention which he commands from an unwilling audience, and the high, the exceedingly high character which he has established with the country. The personal qualities, which have chiefly contributed to this success, are, first of all, the perfect evidence of singleness of purpose; next, unwearied industry, both in the house and out of it; and lastly, imperturbable good temper under all the provocations which have been perseveringly, with study and design, administered to him, both by ridicule and rudeness—both by the witty and scurrilous among his opponents.

It is not necessary for us to advert particularly to the aid which Mr. Hume has given to the movements in parliament in favour of the freedom of trade, and, above all, of freedom, where it is most of all important, in the means of subsistence of the people. We have not any occasion to dwell either upon the importance of placing, or the Herculean labour of accomplishing, that emancipation of the working class of manufacturers from thraldom under their masters, which he so recently effected by the alteration in the Combination Laws.

For his services, the public have on many occasions offered him substantial and honourable proofs of their approbation. The city of

London granted him the freedom of the city in an appropriate manner. The Company of Fishmongers enrolled him as one of their body—an honour to him of greater value, as that company have for the past century been strenuous supporters of liberal principles and the rights of the people. The cities of Glocester, Monmouth, Nottingham, Berwick, and others, have presented Mr. Hume with their freedom. Addresses and votes of thanks from many of the counties of England have expressed the public opinion of Mr. Hume's services. His constituents in Montrose, Brechin, Arbroath, and Aberdeen, have presented him with pieces of plate to record their approbation of his conduct: and his late conduct in declining the presents of plate from the operatives at Glasgow, Leeds, Sheffield, and many other places, are strong proofs of the opinion these bodies hold of Mr. Hume's character. It is too long a catalogue here to record all the public testimonies which Mr. Hume has received from a grateful country; but among the testimonies which he has received of the esteem in which he is held by his countrymen, we must not omit to mention his election in 1824, and re-election in 1825, to the office of Lord Rector of the University and Marischal College of Aberdeen; because it affords an illustration of the mode in which every opportunity of interfering to a useful purpose is seized by his indefatigable spirit of improvement. His proceedings as Lord Rector promise to lead not only to most important advantages to the University which raised him to that honour, but to the state of education in Scotland at large.

If we are asked what are the chances that Mr. Hume will continue hereafter in the same useful line of action in which he has heretofore appeared, and that he will not yield to those temptations which are apt to assail every man who becomes to a certain degree a man of consequence?—we answer, that though it is impossible to do more than form a probable conjecture respecting the future conduct of any individual, it is not easy to conceive a man in respect to whom the improbability of his altering his course may be more strongly affirmed.

Mr. Hume is not a man whose habits are of a slight and transient nature. They are strong, and rooted, and govern the man. Of these habits, industry and good economy, the hatred of waste, in every shape, and in every quarter, are among the most conspicuous. Mr. Hume has greater pleasure in preventing waste, than other people in making it. There is every reason, therefore, to conclude, that he will go on preventing it. In the next place, there is no man living to whom it would be more difficult for ministers to find any thing to offer, which would operate upon him as a bribe. Any greater riches than he already possesses, would to him be absolutely useless. The mode of living which he now adopts, handsome on the scale of a moderate fortune, is such as his taste, his opinions, and his habits, would prevent him from altering if he were ten times as rich. Titles and ribbons to a man of his feelings are devoid of attraction; and as for power and place, his ambition is far more intensely gratified by the space which he occupies in the eye of his country, and the power to be useful—the best of all powers—which he already commands. Without assuming for Mr. Hume more of virtue than belongs to the average of other men, we may affirm that there is in his tastes, his habits, his very likings and dislikings, a security for incorruptibility, which nothing but the highest virtue can exceed.

THE GLASGOW
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

" Knowledge matures the judgment, polishes the character, and refines the heart."

No. LXXXVII. *Saturday*, 20*th August*, 1825. Price 3*d*.

SAINTMARC'S MODE OF DISTILLING FROM POTATOES.

Fig. 1.

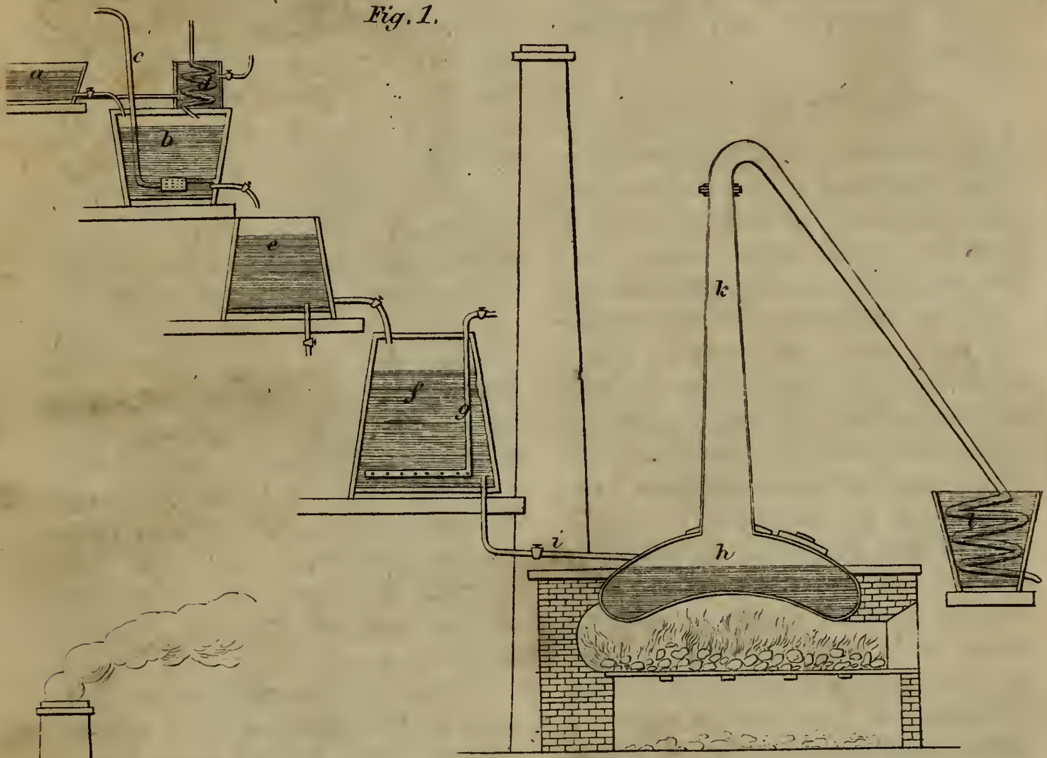
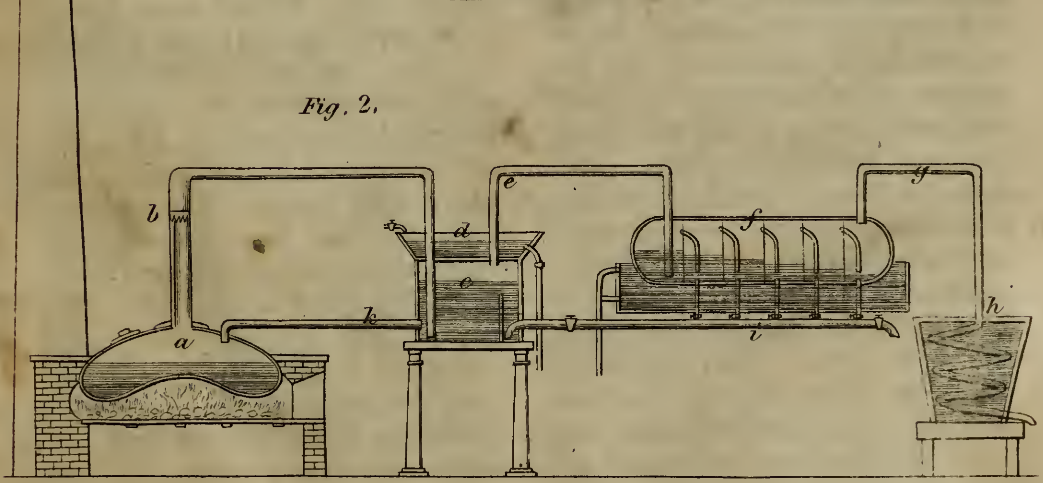


Fig. 2.



—— Swan Sc ——

DISTILLATION FROM POTATOES.

To Jean Jacques Saintmarc, *of Belmont Distillery, Wandsworth Road, Vauxhall, in the Parish of Saint Mary, Lambeth, in the county of Surrey, Distiller, in consequence of Communications made to him by certain Foreigners residing abroad, and discoveries by himself, for the Invention of Improvements in the Process of, and Apparatus for, Distilling from Potatoes.*

[Sealed 20th March, 1824.]

The intention of the patentee is to distil alcohol from potatoes, and the subject of his improvement is described under two heads: *viz.* the mode of preparing the potatoes, ready to be converted into wash, and the general arrangement of the apparatus, for conducting the fermentation and distillation, so as to retain the natural flavour of the spirit, and at the same time economise the use of fuel.

It is first proposed to wash the potatoes free from the earth which adheres to their skins, by placing them in a rotatory drum, formed by open rails or staves, which drum is immersed in a trough or other vessel filled with water. When thus cleaned, the potatoes are to be introduced into a mill, for the purpose of being ground to a pulp. The construction of the mill to be employed is rather peculiar; it consists of a box, as usual, containing a cylinder having ribs of iron set into the periphery of the cylinder, which ribs are to be notched, or formed on the outside into teeth like fine saws. Two pieces of wood at right angles, the one standing in a perpendicular, the other in a horizontal direction, are to be brought up against the cylinder on one side, and the potatoes introduced from a hopper above, are let fall between the cylinder and the wood, when, by the rotation of the cylinder, at the rate of about four hundred revolutions per minute, the potatoes become ground to a pulp, which descends into a receptacle below, there being a wooden scraper behind the cylinder, in order to prevent the pulp from adhering. The perpendicular piece of wood is made to give way by means of a spring behind it, for the purpose of allowing the larger potatoes to come in contact with the cutting cylinder, and the horizontal piece of wood is adapted with screws, in order to keep it up constantly against the cylinder which wears away the wood as it revolves.

The pulp of the potatoes thus produced in the mill, is now to be mixed with a considerable quantity of water, sufficient to bring it into a liquid state; it is then strained through a sieve, and such portions of the potatoe as will not pass through the sieve are rejected as useless, and set apart for feeding animals.

The liquor thus strained, is then to be poured into a sort of cullender or vessel having many holes, which vessel is lined with a cloth; and here the pulp is allowed to settle, and the water to drain away, leaving the substance of the potatoe in a cake at bottom. This cake is then laid out upon a plaster floor, that its moisture may be drawn out by absorption, and afterwards it is dried in a kiln, where it may be kept perfectly good for a very great length of time.

In commencing the process of distillation from the prepared potatoes, the cake must be first broken and dissolved, by mixing with hot water till it has assumed the consistency of cream. A quantity of this liquor is then placed in a vat, which may be supposed to be situated as shown at *a*, fig. 1. This figure shows the whole range of apparatus in action, from the vat, *a*, in which the pulp is first introduced previous to fermentation, down to the worm where the distilled spirit is ultimately condensed.

Let the quantity of potatoe pulp introduced into the vat, *a*, be equal to about three hundred weight when in a dry state, but mixed in the vat with hot water, to about the consistency of cream, as before mentioned; let there be water poured into the vessel, *b*, until it rises about six inches from the bottom, and into this water introduce twenty pounds of sulphuric acid, observing that the vessel, *b*, should have a lining of lead, to prevent the action of the acid upon the wood. The cock of the vat, *a*, is now to be opened, and the liquor contained therein, allowed to flow into the vat, *b*, which is called the decomposing vessel. Another portion of the potatoe pulp may then be mixed in the vat, *a*, and let off into the vat, *b*, as before; and so on until the vat, *b*, is sufficiently full. The proportion of acid to the pulp, necessary for decomposing it, should be from two to three pounds of the former, to every hundred weight of the latter.

Steam is now to be sent into the vat, *b*, through the pipe, *c*, from a boiler, and by means of this steam, the liquor in *b*, is made to boil, and is to be kept boiling for four or five hours. The steam which evaporates from the vat, *b*, is allowed to pass up a worm pipe in the tub, *d*, which, by that means, heats the water in the tub, so that none of the heat is lost, and hot water may then be drawn from the tub, through a pipe, to supply the vat, *a*.

After the boiling in the decomposing vessel is complete, the liquor is let off into the third vat, *e*, which is called the saturating vessel. During the time that the liquor is flowing into this vessel, a quantity of lime and water, or chalk and water, is introduced in order to neutralize the sulphuric acid; two or three pounds of chalk is generally sufficient for one of acid, but the introduction of the chalk, or lime, must be continued as long as any effervescence arises from the liquor.

When the liquor has subsided in the saturating vessel, it is to be drawn off into the fermenting vat, *f*, where a quantity of yeast is added to promote the fermentation. The temperature of this vessel is to be kept up to about ninety or one hundred degrees of Fahrenheit's thermometer, and the room in which the operation is going on to eighty or eighty-five degrees, during the whole time of its fermenting, which usually takes fifteen or twenty days. To facilitate the fermentation, hydrogen gas is proposed to be injected into the liquor, by means of a force pump, through the pipe, *g*, which has a number of small holes in the lower part of the pipe, branches from which are coiled about the bottom; but this injection need not be made when the carbonic acid gas, which escapes, contains an excess of hydrogen. This mode of introducing hydrogen into the wash, may be advantageously employed to facilitate fermentation, whenever liquor is intended for distillation. The sediment of the vat, *e*, should be stirred up, to prevent the loss of any saccharine matter, and allowed to run into the fermenting vat.

When the process of fermentation is complete, the liquor is to be run from the vat, *f*, into the still, *h*, through the pipe, *i*, and is then to be operated upon in the usual way.

The form of this still is, however, something different from those stills commonly used; it is without the usual hand, and it is here intended that the evaporation shall pass up the long tube, *k*, in doing which, it will become partially condensed, and run down again into the still; but the more volatile or spirituous part will pass over the neck at top, and proceed down the pipe to the worm, *l*, immersed in cold water, where it will become condensed, and discharge itself at the extremity of the pipe into any vessel placed under it.

The produce of this first distillation is called low wine; it is therefore necessary to pass the liquor again through the still before it becomes a highly concentrated spirit. For this purpose, it is to be carried to another still, shown at *a*, fig. 2. Here the operation of distilling is conducted in the ordinary way, and the spirituous vapour passing up the pipe, *b*, descends into the closed vessel, *c*, which is cooled by a reservoir of cold water, in a trough, *d*, at top. Here the spirit boils, and as it rises, passes up the pipe, *e*, and descends into the long cylindrical vessel, *f*. This vessel is immersed in a trough of cold water, and is divided by partitions into six compartments, having small bent pipes leading from one to the other. The heaviest portion of the spirit condenses in the first compartment, and the volatile part proceeds through the pipe to the next, where the second heaviest becomes condensed, and the lightest passes through all the compartments, and proceeds through the pipe, *g*, to the worm immersed in the tub, *h*, from whence it discharges itself into a suitable receiver.

The spirit condensed in the cylindrical vessel, *f*, may be passed through the small pipes at the bottom of each compartment into the long pipe, *i*, and from thence drawn off for rectification; or it may be passed from the long pipe into the closed vessel, *c*, and from thence through the pipe, *k*, to the still for further distillation.

The specification concludes by stating that the invention consists, first, in the process by which a spirituous liquor is obtained or extracted from potatoes; and, secondly, in the improved arrangement and construction of apparatus for effecting the processes of fermentation and distillation.

[Inrolled September, 1824.]

Method of obtaining Brandy from Potatoes.

By Mr. Piemens.

The potatoes are put into a close wooden vessel, and there boiled by steam, which is communicated to them at a degree little above that of boiling water; after they are boiled or steamed, they are reduced to a paste with extraordinary facility, (which is done by machinery in the interior of the wooden vessel,) they then add boiling water to the paste, and a little potash rendered caustic by quick lime, the addition of the alkali is to dissolve the vegetable albumine, which prevents the complete conversion of the potatoes into starch.

The starch liquor, after being filtered and evaporated, gives a residue very pure and susceptible of being treated chemically: our correspondent says, "I think they mean distilled." They then draw off the brandy from the potatoes, which has the proper herbaceous taste, it is then mixed with chlorate of lime, by which process the brandy is rendered equal to that distilled from wine.

It will be observed that there is some difference between this process of obtaining spirits from potatoes, and that described in the immediately preceding article.

ON GRAFTING FRUIT TREES.

3.—*Crown Grafting.*

The third method I promised to describe of grafting fruit trees, was *crown grafting*, to which I shall now proceed.

In this mode, two or more grafts are inserted into the horizontal crown of the stock. It is chiefly practised on large trees, of which the wood is too stubborn to be cleft. Either the head of the stock or one of the large branches, is sawed off horizontally, and pared smooth. The rind at the top of the stock is then raised to admit the scions between the wood and the bark, and kept raised by a fine thin wedge. Each scion is to be pared away on one side of the lower part, for about two inches, so as to make that side flat, and leave a shoulder forming a right angle in it. Introduce each scion between the wood and the bark of the stock, so that the shoulder of the scion may be in contact with, and rest upon, the crown of the stock: or, when all the scions are inserted, and the wedges withdrawn, bind them in with bass; and cover, with a composition of clay, the whole crown of the stock to the height of, at least, an inch; rounding it off, so as to prevent any wet, &c. from lodging in it.

As in this method the scions are merely placed between the rind of the stock and the wood, they are liable to be blown out by violent winds, even after they have made large shoots, sometimes after the second or third year. To prevent this, they should be supported by bare stakes, till they have nearly grown over the crown of the stock.

The operation will be the more successful if not performed till the sap of the stock has begun to rise, which renders the bark more easily separable from the wood.

C. D.

Woodside, 4th August, 1825.

MONUMENT TO JOHN KNOX.

The subscribers to the monument for John Knox have commenced their operations, and have contracted with Mr. Carmichael, mason, for erecting the building. The site chosen is one of the most singular about Glasgow. It is on the highest point of the Craigs Park, overlooking the top of the High Church; and the hummock of greenstone, incumbent upon freestone, upon which the foundation will be laid, is exactly 191 feet above the level of Clyde, being altogether solid rock from the milldam below. From this level there is a view of the city and surrounding country, which is truly grand; and the monument, on such an eminence, will be seen to great advantage in every direction, and will, at the distance of a mile or two, seem connected with the High Church. A more happy, grand, and romantic situation for such a monument could not elsewhere be found. The permission to build the monument on this site was given by the liberality of the Merchants' House, to whom the Craigs Park, with its romantic, winding, and beautiful walks, belong. The monument is to be a doric column, 60 feet high, surmounted with a colossal statue of John Knox.

ESSAYS ON BLEACHING,

By JAMES RENNIE, A. M. Lecturer on Philosophy, &c. &c., London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION III.

Of the Mineral Alkali.

SODA is procured in a similar manner with potash, by incineration and afterwards lixiviating; but from vegetables of a very different habitat. Potash is manufactured chiefly from trees; while soda is made exclusively from marine plants, when it is procured from vegetables. Sometimes it is found native, as in Russia and in Egypt, where it is called natrou. But, however much it may differ from potash in its appearance and in the plants whence it is obtained, when used as an agent in bleaching, there is little difference of its effects, provided that the strength of the ley and other circumstances shall be equal. Hitherto the exorbitant price of this commodity has excluded it from being used in the bleachfield, but as more economical modes are now contrived, and as it is made of great purity, there is little doubt that it will now soon be introduced, particularly as it is admirably calculated for the finishing process of the finer fabrics of muslin. Ramsay, from whom I take these remarks, adds, that six ounces of pure carbonate of soda, with ten ounces of soap, produce detergent effects equal to a pound and a half of soap used alone. The oxy-muriate of soda, as will afterwards be detailed, is sometimes used in calico bleaching, and must require this alkali in a crude state for its manufacture.

Barilla is obtained chiefly on the shores of the Mediterranean, from the salsola kali, the salicornia, and the chænopodia of Linnæus, which are dried to the same degree as hay, and burned in pits like those used with us for kelp, which reduces them to a greyish blue mass, containing more or less mineral alkali. When broken, it presents a blackish fracture. It usually contains from 20 to 24 per cent. of pure alkali; but the superior sort of it, called sweet barilla, sometimes contains 33 per cent. The contaminating substances are charcoal, and sulphate, or muriate of soda.*

This alkali is also manufactured in Britain from marine plants, chiefly fuci, which grow on our shores. It is called kelp, and is much inferior to the barilla imported from Alicant and Carthagena; containing only from 3 to 8 per cent. of pure alkali. Its inferiority has been ascribed, and apparently with much justice, to the rude and careless manner in which it is commonly manufactured. (See Jamieson's M. of the S. Isles, vol. II. 44.) Sulphur commonly exists in a considerable proportion in kelp. Mr. Kirwan found this proportion as high as 4 grains in the ounce, in the best Cunnamara kelp, and that of Strangford seemed equally sulphurous. (Trans. R. I. Acad. III. 23-4.)

Before stating the mode of analyzing barilla and kelp, it may not be improper to mention a prejudice which commonly influences bleachers in purchasing those commodities, and which is founded on a mistaken view of their chemical properties. When a parcel of those crude alkalies has lain in the storehouses for any considerable length of time, the action of the air causes the larger pieces to break down, and to assume a very different appearance from those recently imported. When the ignorant bleacher sees this, he sets a very inferior value on the goods, and frequently refuses to have them at any price. Now, chemistry teaches us that the fixed alkalies are imperishable, and cannot be injured by keeping, except they be dissolved by moisture, or washed away by rain. The only circumstance which could depreciate alkalies in the state just described, is their absorption of carbonic acid and water, whose proportions can be easily ascertained, and the consequent depreciation of value deducted. Nay, these alkalies are rather improved, for the purposes of bleaching, by age; for, by the absorption of carbonic acid, the alkaline sulphuret which they may have contained is decomposed, and the sulphur separated; whence a much purer ley can be obtained than from barilla or kelp, recently procured.

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* Some very peculiar doctrines are stated by Mr. Parkes respecting barilla. He says that all marine plants, except those cultivated for barilla, yield potash, and not soda, by incineration. He was led into this opinion by obtaining great quantities of muriate of potash from kelp, to the extent even of many hundred weights per ton. He imagines that the soda of kelp is not derived from the burnt weeds, but from the operation of the potash on the sea salt, producing a decomposition, forming carbonate of soda, muriate of potash.—*Chem. Catech. p.* 158.

I am of opinion that this mistaken notion, concerning alkalies, may have arisen from a remark made by Dr. Home. (Exper. p. 158.) "These ashes," he says, "ought to be close shut up in casks; for, if exposed to the open air, though in a room, the alternate moisture and drought must fix their most useful parts. They become less pungent by keeping, and that on the outside, while their pungency remains internally!" And again, (p. 47,) "Muscovy ashes turn weaker every day, till at last they become quite effete." This is obviously from the absorption of carbonic acid; and he does not seem to have known that this could speedily be extracted by quick lime.

I would earnestly advise the bleacher in no case to trust to tables for ascertaining the qualities of the alkalies he is about to purchase. Such have been given by Kirwan and Descroizilles senior, but they are calculated only to mislead; for every parcel of the crude articles of commerce differs in its proportions of real alkali, even supposing it to come from the same manufactory. He must ascertain for himself the purity of every parcel, if he wishes to profit by his business. Barilla and kelp may be examined in the same manner which has been already directed for trying potash, or by the method which I shall here lay down, and for which I am indebted to Mr. Parkes.

When any parcel of kelp or barilla is to be analyzed, as fair an average sample as possible is to be selected, by breaking small chips from several large pieces, and mixing those with a fair proportion of the small which may belong to the lot. Let a sample, thus selected, be pulverized in an iron mortar, that the whole may be equally mixed; about an ounce of this is to be ground to an impalpable powder, to facilitate the disengaging of the pure alkali. Take of this powder 100 grs., and pour upon it two ounces of pure water; stir it occasionally for a few hours, with a glass rod; allow the insoluble matters to subside; pour the supernatant liquid on a paper filter; and add other two ounces of water to the residium. The whole is then thrown on the filter, in order to secure any lime or carbonate of lime which may be present, and would occasion inaccuracy; upon which a little water is also poured to wash out what remains in the residuum. Both the filtered solutions are then to be put into a vessel, and reduced, by boiling, to two or three ounces. Take two ounces of diluted sulphuric acid, of the specific gravity of 1.100; weigh it accurately together with the phial, and note down their weight in grains. Pour some of this acid very gradually into the solution, and stir it till it ceases to effervesce; when, if it turns red litmus paper blue, more acid, say a drachm, is to be cautiously added, and after stirring, it is to be again tried with the test paper. When the paper begins to be affected but slightly, the acid should only be added by a few drops at a time. The complete saturation of the solution with acid will be known from the effervescence wholly ceasing; the separation of the sulphur held in solution; and from its not tingeing the test paper. The alkali having thus been rendered neutral; the acid in the phial which has not been used, is to be again accurately weighed, to ascertain how much it has required to saturate the alkali; whence it can easily be calculated how much real alkali the sample contained, when it is known how much acid a pure alkali will take up. Mr. Parkes ascertained that 100 grains pure potash requires 520 grains of sulphuric acid, of the specific gravity of 1.100, to saturate it; and 100 grains of pure soda requires 812 of the acid. From this it is evident, that before commencing the analysis, it will be necessary to learn whether the sample is potash or soda, or a mixture of both. The crystals of nitro-muriate of platina, dissolved in water, will furnish a test for this purpose, as when it is dropped into any alkaline solution, it will precipitate potash, but will not affect the soda.

Mr. SNODGRASS'S IMPROVEMENT ON THE STEAM ENGINE.

Gentlemen,—In No. LXXXVI. of your Magazine, you have inserted a letter from an Anderston Correspondent, calling himself an Engineer, containing some remarks on my improvement on the steam engine, on the conduct of the Editor of a certain Newspaper in announcing my invention, and on the conduct of the Magistrates of Glasgow for "granting premiums for improvements without appointing persons properly skilled and of known talent to investigate the claims." As I am aware that the Editor of the Newspaper and the Magistrates of Glasgow can vindicate, better than I, *their conduct*, which he would insinuate to be *grossly ignorant* in this affair, it only remains for me to vindicate my own.

Your Anderston Correspondent has certainly not read the memorial and description of my plans, which were attested by certificates from an eminent engineer and several master cotton-spinners in this city and neighbourhood, before they were transmitted to that respectable body who awarded the premium, otherwise he would not for a moment have thought of attacking them in the manner he has done, or have supposed that I laid any claim to the *original idea* of brass packing. So much, indeed, was the reverse the case, that, in that memorial, I pointed out two patents that had been lately taken out for such plans of packing pistons in steam engines, which, as well as Cartwright's, are as totally different from mine as any thing in mechanics can be. The expense of these plans would cost more in pounds sterling, than mine would cost in sixpences: they must be executed by the very best workmen; and, when finished, it is easy to show that they cannot possibly be steam-tight, particularly that of Cartwright's, a defect which renders them perfectly useless, at least in low pressure engines. Accordingly, after the most diligent inquiry for some years past, I have never been able to find any of Cartwright's packing in use, and I believe that none of the other plans have ever been adopted, for the obvious reason I have mentioned.

The *original idea*, therefore, can be of no avail to the public, till some person apply it to a *plan* which can be brought into general use; this is all the merit I claim, and it is really gross ignorance in your Anderston Correspondent to assert, that I attempted to make any other claim in the face of such existing facts, which even a half informed mechanic must have known.

At Manchester, in January last, I had an opportunity of inspecting the latest patent plan of brass packing, as then executed; but instead of being *in use*, it was merely lying in a respectable engineer's shop for the inspection of strangers. This packing was calculated for an engine of twenty horse power, and cost about £40; my packing for an engine of the same power would cost only twelve shillings, (metal at first cost,) and after being in use from six to twelve months, according to the good or bad condition of the cylinder, would sell for four or five shillings as old metal; besides, it can be executed, with the packing perfectly steam-tight, by the most ordinary engine-keeper, as easily as by the most expert workman. If this be not an improvement, I must plead ignorance of any thing mechanical.

The other savings in expense, and advantages arising from this improvement, it is unnecessary for me to detail here, but if any *impartial engineer* would take the trouble to investigate the plan, I pledge myself to satisfy him fully of its importance, and that I never laid the smallest claim to the *original idea* of brass packing.

Permit me, however, to notice my plan of saving grease, which your Anderston Correspondent has overlooked, although particularly combined with my plan of packing, in my claim to Coulter's premium. This *idea* is *original*, as far as I know, and since he lays so much stress upon originality of ideas alone, he ought to have said something respecting this part of the invention.

Your famed impartiality will, I hope, lead you to give a place to this letter in your Magazine, and thereby oblige, though *only* a cotton-spinner,

Your constant reader,
NEIL SNODGRASS.

Mile-End, 15th August, 1825.

STIRLING SCHOOL OF ARTS.

A FEW weeks ago, we announced the commencement of this Institution, and we expressed our hopes that the good people of Stirling would lay aside their little feuds, and, under the guidance of their worthy chief magistrate, their excellent clergyman, and the other members of the committee of management, would, in future, expend a portion of the ardour, which has hitherto been so differently employed, in the pursuit of science and the attainment of knowledge. It gives us renewed pleasure to be able to say, that, since then, a series of six lectures has been delivered by Mr. Macome of Paisley, to crowded audiences; and that, besides those for whom the Institution was more immediately intended, the lectures were attended by a considerable portion of the wealth and beauty of the town. Mr. Macome, previous to concluding his short course, delivered an address, the sentiments of which certainly do him much credit, and which we would have wished much to give, would our limits permit. After he had finished, he was addressed by the Rev. Mr. Bennie, the vice-president of the committee, who returned thanks in a speech richly characterized by that manly independence and liberal principle which marks all his actions, and exhibiting a farther specimen of the power and vigour of his intellect—his striking and commanding eloquence. We cannot help congratulating the Stirling School of Arts in possessing so ardent—so enthusiastic an advocate; the people of Stirling in having so pious, so talented, so unwearied a pastor. The speech contains so just a tribute to Mr. Macome, and so warm and unanswerable a defence of Mechanics' Institutions, that we cannot help inserting it.

Mr. Macome.—At the request of the Committee, I rise to convey to you the expression of their thanks for your kindness in delivering a course of lectures, with a view to encourage the School of Arts lately formed in this town. They have been much gratified by the warm interest you have felt in the prosperity of their infant institution, and they beg leave to congratulate you on the ability and learning displayed in the lectures you have this evening concluded. In the most candid and modest terms, you have repeatedly disclaimed all pretensions to originality in these lectures; but I am sure I speak the sentiments of the Committee when I say you are justly entitled to high praise, if not for originality, at least for perspicuous statements, accurate research, and impressive manner. The subjects you have illustrated, though not immediately connected with mechanical philosophy, have all been extremely interesting; and it is evident, from the eager attention with which your illustrations have been listened to, that you possess in no ordinary degree, the art of stimulating curiosity and arresting the mind. There is one respect, in particular, in which I think you are entitled to unqualified commendation: in traversing those wide regions of science which you had selected as the subject of your observations — in explaining the sublime phenomena they exhibited—and illustrating the admirable contrivances and the beautiful harmony which we every where discern in the system of the universe, you have never neglected to lead the thoughts of your hearers to the supreme invisible Being by whom all this mighty system was created and arranged, whose glory it reflects, and whose goodness it declares. This is the noblest use of science; and it is when fulfilling this use, that it most highly promotes the improvement and supports the dignity of man, making the earth a temple which perpetually resounds with the voice of praise, and filling the immensity of space with the majesty of God. Science thus purifies the mind it invigorates and expands, invests its speculations with a commanding dignity, and, in the emphatic language of the poet, teaches its votary

"To look through nature up to nature's God."

In the lectures you have delivered, you have invariably sought to mingle the sentiments of an elevated piety with the views you have unfolded; and have pointed out, in the wonderful facts you have explained, the traces of that wise design, which may be discerned by the curious eye, even in the floweret of the vale, and the pebble of the brook. It is with pleasure, therefore, I express the thanks of the Committee for your zealous and able labours in their cause; we consider ourselves as signally indebted to you for the handsome manner in which your services were offered; and now, that these services are closed, we only regret it is not in our power to reward you more amply for the distinguished merit you have displayed.

I cannot but rejoice in the views you have stated regarding the intellectual improvement of man. I confess it is under the influence of such views that I would be most heartily disposed to support and encourage those institutions which have lately been formed for the instruction of mechanics; for though such institutions will unquestionably be useful in making their members familiar with the principles of their daily arts, yet I think there is a still higher use which they are destined to fulfil, in the mental vigour they will impart, and the enlightened curiosity they will awaken. It is astonishing, on the one hand, how various are the pleasures which knowledge supplies, and, on the other, how numerous are the evils which ignorance entails. I wish to see the mind of man active and unfettered—thirsting for knowledge—superior to prejudice—and open to conviction. For it is only when habits of reflection are acquired and maintained, that man assumes his proper rank in creation, asserts the high and inalienable prerogative of reason, and appears as the priest and interpreter of nature. It is mind alone that gives to man his peculiar dignity. It, indeed, is the source of all that is great in nature, and useful in art—the hidden but powerful spring which animates all existence, visible and invisible; and, in proportion as it is improved and strengthened, man approaches more nearly to that infinite unchangeable Spirit, in whose image he was formed, and by whose providence he lives. With such views, I beg to congratulate most cordially the members of this Institution on the means and opportunities which are now afforded them. I trust that to many this will be the commencement of a career of useful and enlightened reflection; and that, awakening to a sense of the dignity of knowledge, they will be taught to exert the admirable powers of their nature, in inquiries calculated to widen the sphere of their views, and to refine the best sentiments of the heart. It is not easy to overrate the importance of scientific instruction. For, of all the speculations that relate to this fleeting life, those of science are unquestionably the most profitable and sublime. Here the mind will be introduced into a new region, unbounded in extent, and most various in its objects, whilst there will be no scope for those angry feelings and sordid animosities which so frequently ruffle the calm aspect of life, and embitter, with a disgraceful hostility, the purest enjoyments of the soul. Every thing here is lofty and invigorating, so that one cannot even touch the border of this delightful region without reviving under the breath of its atmosphere, and experiencing a satisfying pleasure in contemplating the beauty and splendour of the objects which it contains.

But these are themes on which we might long expatiate without weariness or regret. In the mean time, without enlarging, allow me to say, it is gratifying in the highest degree to think our infant institution has been so remarkably favoured with the patronage and support of men of affluence and rank. I am particularly gratified with the liberality displayed by the civic rulers of this town, on the present occasion; it certainly adds another to the claims which they already possess, on the respect and esteem of their constituents. The patronage we have received reflects the highest honour on the character of those by whom it has been conferred. There is now among the rich no mean jealousy of their inferiors. They are themselves so conscious of the benefits of knowledge, that they are anxious to see them enjoyed by the poor. I sincerely hope their generous wishes will be realized; that there will be an impulse imparted to the public mind which time will only strengthen and increase; and that we have now laid the foundations of an edifice, which, unlike those constructed of perishable materials, will tower unshaken amidst the vicissitudes of many generations, and remain a proud and stable monument of that high spirit of philanthropy which, in this age, hath attained a vigour and activity which the prejudices and the passions of men can no longer resist or control. There is at this moment a great public movement in the cause of knowledge. The mounds and fences which ignorance and prejudice had reared to check the progress of thought, are now broken down; and the mind of man, in the sweep of its majestic course, asserts more boldly than ever that supreme dominion over matter, which is its peculiar privilege and right. The glow of intellectual life is kindling even in the obscurest retreats of society. You may attempt to stifle and destroy it—but it is immortal, and will daily wax stronger, 'till, more than rivalling the potency of the magician's fabled wand, it will change the very bleakness of life into beauty, and shed around it, far and wide, the blaze of a pure and undecaying glory.

There is one sentiment which has been happily expressed, to which I wish for a moment to advert; it is, that political opinion and feeling should never be allowed to interfere with the objects of this Institution. I most heartily concur in this sentiment. We have nothing to do here with those bitter feelings which political discussions usually awaken. In engaging in scientific pursuits, we ascend into a higher sphere than that in which the angry passions and animosities of our nature rage. There is a calm dignity in these pursuits, which should breathe a corresponding tranquillity into the heart. It is truth alone—sublime, beautiful truth—which we are anxious to discover; and whilst rival parties, on the wide theatre of the world, are bitterly contending for opinions and rights—inflaming each other's passions, and indulging in rancorous hatred and scorn, we withdraw from the turbulent and noisy scene to meditate on the mysteries of nature, and enrich our minds with the treasures of knowledge. In the august temple of science the sounds of violence are never heard; there a solemn perpetual stillness reigns; and whosoever would enter that temple to worship, must leave behind him the bitterness, the scorn, and the petty resentments of life. I am aware it has been said the tendency of such institutions is to foster a spirit of political rancour and disaffection. I am astonished, in the nineteenth century, to find such an objection stated. I confess I have no patience to answer it. I will dismiss it with contempt; for, in truth, I cannot but consider it as a sort of insult on the laws and government of the land—an outrage on reason, morality, and religion. Science and radicalism! philosophy and anarchy! What strange combinations! We may well admire the fertile imaginations of the men with whom such an objection could originate. The doctrine is indeed mysterious, that by teaching men to think, you expose them to the influence of prejudice and delusion. What connection is there between the truths of science, and the discontentment of a deluded and irritated people? In the history of the past, has it ever been found that knowledge made the mind unsteady, or that philosophy inflamed the passions? The objection proceeds on the supposition that political government is a flimsy structure which will not bear examination, and that the only way to secure its safety, is to keep the people ignorant, and their minds enslaved. But such opinions are now too late. The more men know, the more likely they are to be cautious and sedate; and no policy can be more perilous than that which would rest the security of the state on the apathy and prejudices of a deluded and uneducated multitude. A despot may well dread the diffusion of knowledge; but a liberal government, such as it is our happiness to enjoy, has nothing to fear, and every thing to hope. But I will not disturb the satisfaction of this moment by adverting to such topics at greater length. Within the sacred inclosure, where we now stand, we disdain to indulge in angry or reproachful feeling; and, therefore, I gladly turn from this objection, to remark, that I now entertain more fondly than ever the hope, that the School of Arts in this town will be a signal and lasting blessing to the community. The favourable auspices under which it has commenced, justify us in anticipating the happiest results. I confess I never experienced a purer feeling of satisfaction than on the evening of the first lecture, when I saw so many mechanics listening with eager interest to the illustrations of their teacher. I had expected a considerable number, but it had never occurred to me there would be so many anxious to acquire information, and to enroll themselves among the votaries of science. The number on each succeeding night has continued to increase; and now, at the close of the lectures, I am confident the most doubtful and cautious must be surprised by the striking effect which has been so suddenly produced. It is indeed gratifying to see the mechanic, when the labours of the day are ended, dedicating a quiet hour to the cultivation of science; and I cannot conceive a more delightful vision on which the fancy of the philanthropist can repose, than that which is exhibited in the knowledge, happiness, wisdom, and dignity, which will thus be diffused and perpetuated—let us trust, to the latest posterity.

NEW COINAGE.

We are much gratified in learning, that an English artist has at length been found worthy of the honour of being employed to produce a series of new dies for the coin of the realm. It has long been a matter of astonishment, that in an age like the present, when the highly cultivated state of the arts in Britain has placed every other country in the shade, the directors of our national mintage should have had recourse to the talents of a foreigner, to produce a series of gold and silver coins, which, without considering the impropriety of the devices, are both, as respects their design and manner of execution, incomparably inferior to a Birmingham halfpenny, or even to the better order of buttons.

The public have now to congratulate themselves upon a new coinage, which will be worthy of the age and nation in which we live. Mr. Wallace, the present master of the mint, has, we understand, personally exerted himself in devising the subjects to be impressed upon the new coin, which certainly reflects great credit upon that gentleman's taste; it is, however, to the talents of Mr. W. Wyon that we are indebted for the execution of a series of dies, certainly superipr in every respect to any coin that has before appeared.

The gold pieces are sovereigns and half sovereigns, double sovereigns, and five sovereign pieces. The silver, crowns and half-crowns; the smaller pieces not being yet sufficiently forward to authorise us at present to expatiate upon their merits; but from the models which we have been favoured with the sight of, we have no hesitation in saying, that their designs display a classic taste, to which our present coins will not bear the most distant comparison.

The five sovereign gold piece is between the sizes of our present crown and half-crown; it contains the profile of his Majesty, in bold relief, looking towards the left, and as far as our recollection goes, appears to be an excellent likeness; it is, we understand, copied from a painting by Sir Thomas Lawrence, and displays the naked neck to the collar-bone; the hair, which appears thick, is, we should say, laid in tasteful disorder; the wreath of laurel that has upon our coins hitherto entwined the brow of the monarch, is here omitted at the express desire of his Majesty; GEORGIUS IV. DEI GRATIA, 1825, encircles the head, and the raised edge of the piece is finished with an internal beading.

On the reverse is a planse shield, nearly square, with the royal arms, enclosed by a raised mantle, which is tied up by tassel cords at the upper corners in bunches, and hangs straight down on the sides, with festoons from the imperial crown at top. The inside of the mantle is represented with knots of ermine, and its outer edge is enriched by an elegantly embroidered border. The arms are quartered, England in the first and fourth, Scotland in the second, and Ireland in the third, with an escutcheon of pretence and crown for Hanover; the fields of the quarterings are bright with the charges, neatly drawn, and raised in bas-relief; the inscription, BRITANNIARUM REX FID. DEF. is in elevated square letters, without the mantle, and the whole encircled by a beaded border, within the raised edge of the piece.

The double sovereign bears the same devices, but upon a smaller scale, and is equally elegant and highly finished.

The sovereign has the same head and inscription, but reduced in size, and its reverse exhibits the plain shield of arms and imperial crown without any mantle, but a tasteful scroll work decorates the edges of the shield, and the inscription is as upon the larger pieces, and the whole device on each side is encircled with a beading in the hollow of the ribbed edge, which is externally milled.

The crown piece in silver, is beyond all doubt the most superb coin that has ever been produced; its diameter is one inch four-tenths and eight-hundredths; the head is from the same model as the former, in very bold-relief; it measures from the point of the chin to the crown, nine-tenths of an inch, and from the crown, down to the lowest point of the throat, one inch and two-tenths. The features, the muscles, and the hair, are produced with infinite taste and ability, equal perhaps to the finest medal that has ever appeared; the size of the crown piece, allowing a larger space for the exercise of the artist's talents than either of the pieces before mentioned; indeed we consider this coin to be a complete *chef d'œuvre* of the art. The head is encircled, as upon the other pieces, with the inscription in raised letters, GEORGIUS IV. DEI GRATIA, 1825, and is, we understand, intended to be the exact model for the face of all the coins that are to be produced in the present reign.

The reverse is extremely beautiful: it consists of a plain shield containing the royal arms, as upon the other pieces, above which in this is the helmit of the sovereign, open, and facing to the front, *gardevisure,* with semicircular bars, and embroidered upon the breast and shoulders; upon this is the imperial crown, and issuant from behind the helmet is a mantle elegantly flowing on the sides of the shield in a variety of tasteful scrolls; and below is a meandering ribbon upon the matted ground, of which is raised the motto, DIEU ET MON DROIT. The inscription, BRITANNIARUM REX FID. DEF. extends round the sides of the coin, and the whole is circumscribed by a bead within the hollow of the raised edge.

The half-crown bears an exact fac-simile of the devices on the crown piece, but upon a smaller scale; the edge of the crown has the usual motto for protection, raised upon a plain rim; that of the half-crown is milled.

We feel that we have not done sufficient justice to the subject before us, but as the coins will very soon be in general circulation, the public will be enabled to exercise their own judgment upon the merits of the execution.

MISCELLANIES.

New Magnetic Phenomena. — At the sitting of the Royal Academy of Sciences at Paris, on the 7th of March, M. Arago exhibited an apparatus for showing, in a new form, the action which magnetized and non-magnetized bodies mutually exert on each other. In his first experiments, M. Arago proved, that a disc of copper placed beneath a magnetic needle, effects the extent of its oscillations, without sensibly altering their duration. Since a needle in motion is stopped by a disc at rest, M. Arago imagined that a needle at rest would be moved by a disc in motion. In fact, if a plate of copper, for instance, be made to turn with any determinate velocity, under a magnetized needle, contained in a perfectly closed vessel, the needle will no longer assume its usual position; it stops without the magnetic meridian, and so much the farther from that plane as the revolution of the disc is more rapid. If the rotatory motion be sufficiently rapid, the needle itself, at whatever distance from the disc, turns continually round on the wire on which it is suspended.

On experimentally examining the above very singular facts, we find that these phenomena are not confined to plates of copper, as many other substances will produce precisely the same results, and we purpose on a future occasion furnishing our readers with a detailed account of these experiments.—*Scientific Gazette.*

Quantity of blood in animals.—Those

who have not considered the subject, must be surprised at the quantity of blood which is propelled through the heart of any moderately sized animal in the course of twenty-four hours. In man, the quantity of blood existing in the body at any given moment, is probably from thirty to forty pints. Of these an ounce and a half, or about three table spoonfuls, are sent out at every stroke; which multiplied into seventy-five, (the average rate of the pulse,) give eleven hundred and twenty-five ounces, or seven pints in a minute; *i. e.* four hundred and twenty pints, or two hundred and fifty-five gallons in an hour; and twelve hundred and sixty gallons, *i. e.* nearly twenty-four hogsheads in a day. Now, if we recollect that the whale is said to send out from his heart at each stroke fifteen gallons, the imagination is overwhelmed with the aggregate of the quantity that must pass through the heart of that leviathan of the deep in twenty-four hours. It is a general law, that the pulse of the larger animals is slower than that of the smaller; but even if we put the pulse of the whale as low as twenty in a minute, the quantity circulated through the heart, calculated at fifteen gallons for each pulsation, will be four hundred and thirty-two thousand gallons, equal to eight thousand hogsheads in twenty-four hours. The consideration of this amazing quantity is, however, a subject of mere empty wonder, if not accompanied with the reflection, that, in order to produce the aggregate amount, the heart is kept in constant motion; and that, in fact, it is incessantly beating, as it is termed, or throwing out the blood in the arteries, from the first period of our existence to the moment of our death, without any sensation of fatigue, or even without our being conscious of the process, except it be interrupted by corporal or mental agitation.

Scientific Literature of China.—This isolated nation possesses a Cyclopedia in sixty-four volumes. It was written by Wang-Hung-Chow, a distinguished Chinese writer, under the reign of Wan-Leigh (about the year 1600.) It was about this time that European missionaries first appeared in China: the author was assisted in it by his son. The work mentions European muskets. The subjects are arranged in the following order: 1st, Astronomy. 2d, Geography. 3d, Portraits of Remarkable Persons, and of the Various Tribes of each Region. 4th, The Mysteries of the Cyclus, and of the Pa-Kwa. 5th, Architecture. 6th, Household Furniture, Implements of Agriculture, Horticulture, Fishery, and War. 7th, Anatomy. 8th, Costume. 9th, Chess, and other games. 10th, Ancient Chinese Characters. 11th, The Botany and Natural History of various Countries. 12th, Boxing and Fencing. 13th, Hewing of Wood. 14th, Dancing. 15th, Various Positions and Secrets for Improving Health and Prolonging Life. 16th, Bull-baiting, Cock-fighting, and other sports of that kind. 17th, Coins, and Engraved Silver Pieces.

Economical Candles.—Dr. O'Neil, of Comber, has discovered a process, by which lard may be used for making candles; he renders this substance superior to the Russia tallow, and not so expensive. The lard, after having undergone his process, resembles white wax or spermaceti. Candles made of this prepared substance, burn with a brilliancy superior to common candles, and it is said even to gas; they are free from any unpleasant smell, and do not feel greasy to the touch, nor give off any smoke; they burn much longer than candles of the same weight, and by a slight alteration in the process, they can be rendered yellow or of any other colour, or as white as snow, which neither light, air, or smoke can alter. We should be happy to hear the particulars of this process, but have some notion that it is the subject of a forthcoming patent.—*Lond. Jour. of Arts and Sciences.*

A Report made by M. Fresnel to the Acad. Royale des Sciences upon the Microscope of M. Selligue.—In the usual form of microscopes, the object glass, when great magnifying power is required, must have a very short focal distance. It thus becomes a matter of great difficulty to illuminate the objects, especially such as are opaque, the rays of light which ought to fall upon the object being intercepted by that part of the microscope which contains the object glass.

In order to obviate this inconvenience, M. d'Amici substitutes a concave mirror for the object glass. He says, that he succeeds in making his small reflectors perfectly elliptical; and that, consequently, not only the inconveniences in illuminating the object are avoided, but also that he removes the defect occasioned by the aberration of sphericity always in some degree incident to the common microscope. The instrument of M. d'Amici is now well known on the continent, and in considerable repute.

M. de Selligue, observing the advantages which are possessed by these instruments, endeavoured to construct a microscope where the object could still be conveniently illuminated, and the aberration diminished, without incurring the expense and difficulty in manufacturing, to which the microscopes of M. d'Amici are subject. He employs, therefore, an achromatic object glass of considerable focal distance, and composes the eye-piece of four small achromatic lenses of equal size. By these he is enabled to carry the magnifying power as high as nine hundred.

It is the opinion of M. Fresnel, who was appointed by the Acad. Royale to examine into the merits of this invention, that the instrument of M. Selligue is much superior to those in common use, for observing opaque bodies, and also for transparent bodies, when the magnifying power does not exceed two hundred. It is also cheaper and much more easily constructed than the microscope of M. d'Amici, this gentleman not having published the mode in which he renders his mirrors perfectly elliptical. It is therefore esteemed by M. Fresnel, to be a valuable addition to our optical instruments.

USEFUL RECEIPTS.

Essence of Lemon, gives a fine flavour to preserved fruit.—One of our Correspondents recommends to those making jam or jelly at this season, the use of essence of lemon to flavour these preserves. We thought this had been pretty generally known; we have long practised it ourselves, and therefore recommend it to all our friends. A very small quantity of lemon essence suffices to flavour a considerable quantity of jelly.

Cotton Thread preferable to Flax for Shoes.—We would strongly recommend to those among our readers who may be shoemakers, the use of cotton thread instead of flax in the manufacture of shoes. It is said that shoes sewed with cotton thread are worth ten or twelve per cent. more than those sewed with flax, so much longer do they last.

To preserve the face from being pitted with Small Pox.—After the eruption, and when the pustules begin to swell, and be filled with the pus or matter, take chalk, thoroughly pulverised, and mix it with fresh cream, so as to make a kind of liquid pomatum, that it may the more easily be laid upon the patient's face; for which purpose, a feather is to be used, and as the pomatum dries, the anointing is to be renewed. Thus, the patient will not be tempted to scratch, the coolness of the cream preventing the itching, and the chalk with which it is mixed, insensibly drying up the matter of the pustules, hinders it from penetrating into the flesh, and consequently from pitting.

To destroy Flies.—To one pint of milk add a quarter of a pound of raw sugar, and two ounces of ground pepper; let the mixture simmer eight or ten minutes, and place it about your apartments in shallow vessels; the flies attack it greedily, and in a few moments are suffocated. By this method you keep your parlours, kitchen, &c. clear of flies all the summer, without the danger attending poison.

NOTICES TO CORRESPONDENTS.

A Working Mechanic; W. H., Dunfermline; and D. M., Lanark, have been received. We have set about inquiring as to the subject mentioned in the letter of a Mechanic, dated Manchester, and shall insert an answer in our next, or the one immediately following.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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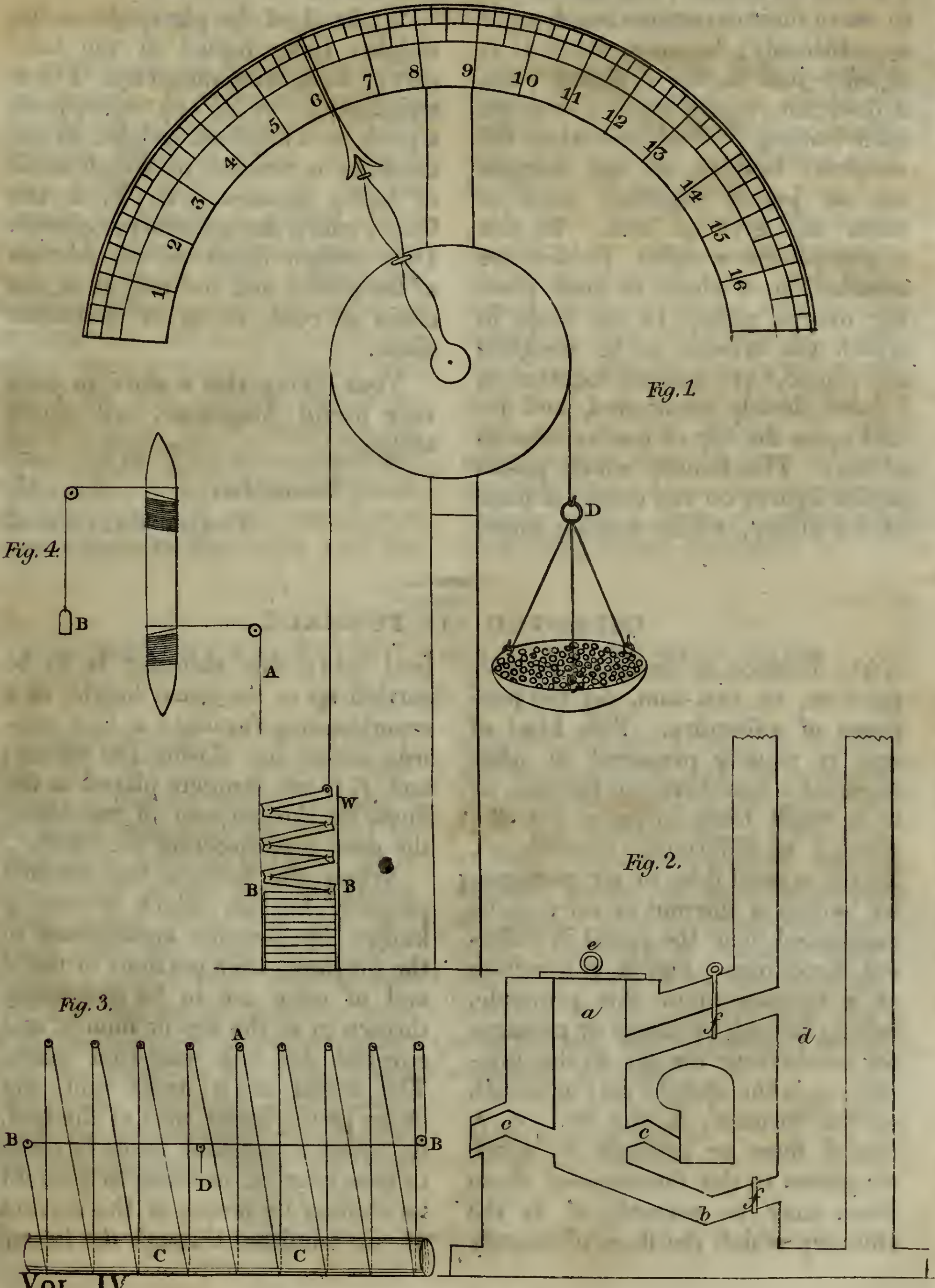
CURLL, PRINTER.

THE GLASGOW
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

> "The mind untaught
> Is a dark waste where storms and tempests howl:
> As Phœbus to the world, is science to the soul."

No. LXXXVIII. *Saturday, 27th August,* 1825. Price 3*d.*

NEW WEIGHING MACHINE, IMPROVED AIR FURNACE, &c.



VOL IV.

— Swan Sc —

NEW WEIGHING MACHINE,

Invented by Dixon Vallance, Libberton, near Carnwath.

Gentlemen,—I beg leave to send you a drawing of a new simple weighing machine, which shows, by a hand pointing to an index, the true weight of whatever is put into the scale. Shopkeepers, by the use of this machine, will be enabled to serve their customers much more expeditiously; because, while it is equally just as the ordinary plan, it does not require time to be taken up in putting in and removing the weights; besides, as the weights are all joined together, none of them can ever be lost. In this machine, the weights, (which are attached to a chain or cord passing over a pulley to the scale in which the articles to be weighed are placed,) are jointed together as I have already mentioned, and are laid upon the top of one another in a box. The handle which points to the figures on the index, is fixed to the pulley, which turning round by the chain or cord passing over it, moves the hand along the index, while the scale, descending as the articles in it are increased, raises just as many of the weights as they weigh, and the amount of which is pointed out on the index.

W, fig. 1 of the plate, shows the weights lying folded in the box, part of them being raised up. These weights may be of any value, from a grain to a hundred weight, as the machine is wanted to weigh small or bulky articles. B, B, is the box in which the weights are placed. D, a weight equal to the friction of the pulley and the weight of the chain or cord, so as to neutralize these.

Your giving this a place in your very useful Magazine, will much oblige,

Yours, &c.
Dixon Vallance.

IMPROVED AIR FURNACE.

This furnace is designed to melt pig-iron, or cast-iron, for the purposes of a foundry. This kind of iron is usually prepared in what is called a reverberating furnace, or in a small blast furnace, but the present is differently constructed, having several flues or air passages, by which a current of air may be conducted over the metal in different directions. Fig. 2, is a section of a furnace upon this principle, having lateral openings or passages for conducting the air to the interior; *a*, is the upright part or mouth of the furnace; *b*, the bed; *c*, *c*, lateral flues or passages by which air passes to the furnace—of these there may be several; *d*, is the chimney which the flues ultimately lead into; this chimney is to be carried up to the usual height of a reverberating furnace; *e*, is a cast-iron cover for closing the mouth; and *f*, *f*, are dampers placed in the flues, for the purpose of regulating the draft and directing the flame.

When the furnace has become properly heated, which is readily known by persons accustomed to the business, then portions of metal and of coke are to be alternately thrown in at the top or mouth, and covered by the cast-iron plate. The metal as it melts will run down to the lower part of the bed, *b*, where a constant flame is made to pass over it, in order to prevent its chilling by means of the current of air admitted through the lateral passages, *c, c, c,* which current passes through the furnace to the chimney, and the fluid metal, when ready for casting, is drawn from the bed by a tap hole as usual.

The form of the furnace may be square, round, oval, octagonal, or of any other figure that may be deemed suitable, provided that the principle is retained, *viz.* that of conducting currents of air in different directions through the furnace, by means of lateral flues, so that the heat may be directed in the furnace as circumstances shall require it to be applied.

IMPROVED METHOD OF BANDING SPINDLES.

A NEW mode of banding spindles for twisting, is at present in use in the thread manufactory of Messrs. William Smith & Sons, in Dawson's Croft, Salford. It consists simply in placing a pulley at the end of the frame, betwixt the roller and the spindles, from whence the band is passed round the roller on to a spindle, and is returned to the roller, from whence it is again passed to the next spindle, and so on in succession, till it comes to the other end of the frame, where another pulley is fixed, through which the band is passed, and from thence carried betwixt the roller and the spindles to the first pulley, where the ends of the band are joined together. By this method of banding, any number of spindles may be driven by one band.

A more correct idea of the mode in which the band passes from the pulley to the spindles, and from thence on to the roller, will be obtained by inspecting fig. 3 of the plate. In this fig. the spindles are seen at A; B, B, are the pullies at each end of the frame; D, the pulley raised from the floor to support the band; C, C, the tin roller; and the dotted lines represent the band going round the roller.

MODE OF PREVENTING THE WARPING MILL FROM FALLING BACK.

GENTLEMEN,—In No. LXIII. Vol. III. of your valuable Magazine, a Warper wishes to know the cause why the mill inclines to fall back in going to the top. It is the weight of the box and heck which causes it to have the tendency, and the cure is simple. Put on a counterpoise with *a cord* over a pulley on the opposite side of the mill-spindle, as shown in fig. 4 of the plate, in which A is the cord of the box, heck, and pulley, and B the counterpoise weight. By this arrangement, when the box and heck are ascending, the weight will be descending, and the opposite will take place when the box and heck are descending. The mill will then be kept perfectly steady whether going up or down with the warp. This is a great improvement, especially in warping hard silk, as the yarn does not slacken. The old method of the cog and rung has the same advantage as to steadying the mill.

A. W.

Paisley, 21st July, 1825.

REMARKS ON PROFESSOR HANSTEEN'S ACCOUNT OF A FALLING STAR, SEEN IN THE DAY TIME.

By Mr. Thomas Dick.

[Professor Hansteen published an account of his having seen a falling star at mid-day, which we, in common with every other Scientific Journal, copied into our pages. The following amusing observations have been published by Mr. Thomas Dick of Perth, the author of the Christian Philosopher, which must carry conviction to every mind, and must make, we should think, the Professor look rather strange.]

In the 24th Number of the Edinburgh Philosophical Journal, page 406, a notice is inserted of a phenomenon having been observed by M. Hansteen, when employed in measuring the zenith distances of the pole star. This phenomenon is described as "a luminous body, which passed over the field of the universal instrument telescope;" and the Professor concludes, that it must have been "a meteor," or "shooting-star," descending from the higher regions of the atmosphere; and that this was "perhaps the only instance in which a shooting-star has been seen at mid-day, in clear sunshine."

That shooting-stars may occasionally pass through the atmosphere, in the day-time, as well as during the night, I do not mean to call in question; but I have good reason for believing, that the phenomenon referred to, was a body of a very different description; and perhaps the following statement may tend to confirm this opinion.

About twelve years ago, I was engaged in a series of observations on the celestial bodies, in the day-time, by means of an equatorial telescope, for the purpose of ascertaining what stars and planets may be most easily seen in the day-time; what degrees of magnifying power are requisite for distinguishing them; how near their conjunction with the sun they may be seen; and whether a diminution of the aperture of the object-glass of the telescope, or an increase of magnifying power, has the greatest effect in rendering a star or a planet visible in day-light. In the prosecution of these objects, I had occasion to make several hundred observations, in different quarters of the heavens. As it was one particular object, in these observations, to determine the nearest position to the sun in which Venus could be seen, I made numerous observations on this planet, when in the vicinity of that luminary. I was not a little surprised, at different times, when searching for the planet, to perceive a body pass across the field of the telescope, apparently of the same size as Venus, though sometimes larger and sometimes smaller; so that I frequently mistook that body for the planet, till its rapid motion undeceived me. In several instances, *four* or *five* of these bodies appeared to cross the field of view, sometimes in a perpendicular, and, at other times, in a horizontal direction. They appeared to be luminous bodies, somewhat resembling the appearance of a planet, when viewed in the day-time with a telescope of a moderate degree of magnifying power. Their motion was nearly rectilinear, but sometimes inclined to a waving or serpentine form; and they appeared to move with considerable rapidity, the telescope being furnished with a power of about seventy times. I was, for a considerable time, at a loss what opinion to form as to the nature of these bodies; but having occasion to continue these observations almost every clear day for nearly a twelvemonth, I had frequent opportunities of viewing this phenomenon in different aspects; and was at length enabled to form a decisive opinion respecting its cause. In several instances the bodies alluded to appeared much larger than usual, and to move with a more rapid velocity; in which case, I could plainly perceive that they were nothing else than *birds* of different sizes, and apparently at different distances, the convex surface of whose bodies, in certain positions, strongly reflected the solar rays. In other instances, when they appeared smaller, their true shape was undistinguishable by reason of their motion and their distance. In a hot summer's day, when making similar observations, I have perceived similar phenomena, which I had every reason to attribute to a number of winged insects flying about at no great distance from the telescope.

From a consideration of the facts now stated, it will, I presume, appear highly probable that the phenomenon which M. Hansteen concluded to be "a shooting star," was nothing more than a bird winging its flight towards the lower regions of the atmosphere, having that part of its body which was turned to the observer strongly illuminated by the solar rays. This opinion is confirmed by the account which M. Hansteen gives of the *motion* of the phenomenon which he observed. "Its motion (says he,) was neither perfectly equal nor rectilinear, but resembled very much the unequal and somewhat serpentine motion of an ascending rocket;" a kind of motion similar to that which appeared in the bodies alluded to above, and which corresponds to the waving motion of a bird through the atmosphere.

The late ingenious Mr. B. Martin seems to have been deceived by a similar phenomenon, and to have drawn from it a conclusion somewhat analogous to that of M. Hansteen. In his "Philosophia Britannica," vol. iii. pp. 85, 86, when describing the solar telescope, and the phenomena which may be exhibited in a dark chamber, he gives the following relation:

"I cannot here omit to mention a very *unusual phenomenon* that I observed about ten years ago in my darkened room. The window looked towards the west, and the spire of the Chichester Cathedral was directly before it, at the distance of about 50 or 60 yards. I used very often to divert myself in observing the pleasant manner in which the sun passed behind the spire, and was eclipsed by it for some time; for the image of the spire and sun were very large, being made by a lens of 12 feet focal distance. And once as I observed the occultation of the sun behind the spire, just as the disk disappeared, I saw *several small, bright, round bodies, or balls,* running towards the sun from the dark part of the room, even to the distance of 20 inches. I observed their motion was a little *irregular*, but rectilinear, and seemed accelerated as they approached the sun. These luminous globules appeared also on the other side of the spire, and preceded the sun, running out into the dark room, sometimes more, sometimes less together, in the same manner as they followed the sun at its occultation. They appeared to be in general about $\frac{1}{20}$th of an inch in diameter, and therefore must be *very large luminous globes* in some part of the heavens, whose light was extinguished by that of the sun; so that they appeared not in open daylight; but whether of the meteor kind, or what sort of bodies they might be, I could not conjecture."

From what has been already stated, there can, I presume, be little room to doubt that the phenomena described by Mr. Martin are to be accounted for in the same way as the phenomenon observed by M. Hansteen; and that the "small, bright, round bodies, running towards the sun from the dark part of the room," were nothing more than a few birds, at a considerable distance, gliding through the air.

ON THE PHENOMENA ARISING FROM THE COLLISION OF VARIOUS BODIES, AS APPLIED TO ELICITING SPARKS.

Steel, in the various forms in which it is usually employed for collision with mineral substances, with a view to elicit sparks, is found to strike fire only with those which are nearly equal in hardness to common flint; and it has hence been chosen by Werner as a criterion for determining one of the most important external characters of minerals, namely, their hardness.

Mr. Benjamin Babington, however, has found, that, under particular forms, steel will be found to strike fire, not only with all minerals of the harder kind, but also with many of those which are so soft as readily to be scratched by it, and also with several other bodies.

There is no form better adapted, he says, for exhibiting this phenomena than that of stiff watch-spring, of which we may take a portion, about four inches long, snapping it off from a greater length, so as to leave a ragged edge at the end. We are thus furnished with a surface from which fragments are easily detached on collision; and the elasticity and curved form of the spring enable us, by a little dexterity, to discharge the end with considerable force, and at any angle we choose, against the body on which we are trying our experiment. Mr. Babington has thus succeeded in eliciting sparks with common glass, crystallized flour, crystallized calcareous spar, various kinds of marble and limestone, carbonate and sulphate of barytes and strontian, iron and copper pyrites, (though the distinctive character of the latter is its being easily scratched with a knife,) black ore of manganese, ores of tin, the polished surface of various sea shells, tiger's teeth, and the tusks of a boar; soft iron, alloy of silver, as contained in a common silver spoon, and as one of the softest substances which I have submitted to experiment, to hydrous gypsum.

Mr. Babington concludes, from this more extended range which steel is shown to take in its power of striking fire with various substances,

1st. That mineralogical works are in error in their statements regarding this character in minerals.

2d. That some better forms than those now in use may, perhaps, be found for producing fire by means of flint and steel. And,

3d. That increased caution should, if possible, be observed in powder mills and magazines, and in working among other highly combustible materials, since substances, hitherto supposed incapable of becoming sources of danger, are thus shown, under certain circumstances, to be adequate to excite by collision the ignition of steel.

DIURNAL VARIATION OF THE NEEDLE.

By Samuel Hunter Christie, Esq.

The diurnal variation, both in the direction of the needle and in the magnetic intensity, appears to have a reference to the position of the sun with regard to the magnetic meridian; it is therefore probable, that the sun is the principal cause of both these phenomena. The circumstance of the situation of the magnetic pole in what appears to be, independent of elevation, the coldest region of the globe, supported as it is by the fact of a diminution of temperature causing an increase of magnetic intensity, would lead us to infer, that the effect produced by the sun is principally to be attributed to the heat developed by it; but should any periodical effects, corresponding to the time of the sun's rotation about its axis, be observable in the diurnal variation, we must suppose that the sun, like the earth, is endued with magnetism, and look for a cause of this magnetism, common to all the planets. Being engaged, more than two years ago, in making some experiments on the effects produced on the needle by unpolarized iron, I discovered that a peculiar polarity was imparted to the iron by simply making it revolve about an axis; and this naturally suggested the question to me, whether the magnetism of the earth, and, consequently, that of the other planets and the sun, might not be owing to their rotation? From the effects which I have observed to be produced on iron by its rotation, it appears probable, if the magnetism of these bodies be not caused by their rotation, that at least the effects will be modified by, and, to a certain extent, dependent on such rotation. Since first observing the fact, that simple rotation will cause a peculiar polarity, if I may be allowed the expression, in iron, I have made a great variety of experiments on the subject, which have enabled me to trace the laws according to which this polarity in the iron affects a magnetic needle, independently of the effect produced by the mass. It would lead me to too great a length here, to state the several effects that are produced by the rotation of iron, or the laws which govern them; but I will briefly mention one. Let us imagine a plane to pass through the centre of an horizontal needle, at right angles to the meridian, and making an angle with the horizon equal to the dip; then, if the plane of a circular plate of iron coincide with this plane, and the plate be fixed on an axis passing through its centre at right angles to its plane, so that it can be made to revolve in its own plane, the direction of the needle will be different, according as the several points of the plate are brought into any particular position, by making it revolve in one direction or the opposite, excepting in four positions of the centre of the plate. If the centre of the plate be successively placed to the east or west of the centre of the needle in the same horizontal line, and over the needle in the plane of its meridian, then the deviation of the needle due to the rotation of the plate will be in contrary directions in the two cases, the plate revolving in the same direction in both. These and other peculiar effects arise entirely from the rotation of the iron, and are not produced by any friction on the axis. As the effects are not very considerable, to render them conspicuous, it is necessary to make use of a plate eighteen inches in diameter, and to have its centre within sixteen inches of that of the needle. If the needle is under the influence of magnets, as in the foregoing observations, the effects produced by the rotation of the plate are considerable.

THE LONDON UNIVERSITY.

THE object of this Institution is to bring the means of a complete Scientific and Literary Education home to the doors of the inhabitants of the metropolis, so that they may be enabled to educate their sons at a very moderate expense, and under their own immediate and constant superintendence. It is known that a young man cannot be maintained and instructed at Oxford or Cambridge under 200*l.* or 250*l.* a year, while the expenses of many very far exceed this sum; and the vacations last about five months in the year. The whole expense of education at the London University will not exceed 25*l.* or 30*l.* a year,* including the sums paid to the general fund; and there will not be more than ten weeks of vacation in the year.

A suitable piece of ground for the buildings and walks, and in a central situation, is now in treaty for; and it is expected that the structure will be completed in August, 1826, and the classes opened in October following. A fortnight's vacation will be allowed at Christmas and Easter, and six weeks from the middle of August to the end of September.

The money being raised by shares and contributions, each holder of a 100*l.* share will receive interest on the same, at a rate not exceeding *four per cent.*, payable half-yearly, and be entitled to send one student to the University. The shares will be transferable by sale and bequest; and they will descend to the holder's representatives in case of intestacy. The money due on them will be paid by instalments, as it may be required; but it is calculated that only two-thirds will be called for; and the remaining 33 per cent. will be considered as a fund of reserve, in case of any extension of the plan, or other unfavourable exigencies. No person can hold more than ten shares. Each contributor of 50*l.* will have all the privileges of share-holders during his life, except that of receiving interest, and transferring his rights.

The interest will be paid out of the revenues of the Institution, and the yearly produce of the sums received from time to time beyond what is required for current expenses. Each student is to pay five guineas a year to this general income, besides one guinea to the Library, Museum, and collection of maps, charts, drawings, and models.

The Rules of the Establishment will be submitted to a general meeting of shareholders; but it is expected that the general opinion will be in favour of vesting the whole government of the Institution in a Chancellor and Vice-Chancellor, and nineteen ordinary Members of Council, chosen by the shareholders by ballot, voting if they please by proxy; a certain number of the Council to go out every year. It is also understood that the emoluments of the Professors will be made to depend on the fees received from students, with the addition of very moderate salaries.

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* This supposes a student to attend five or six of the general classes; but the medical education is necessarily more expensive from the costs of the anatomical department.

APPARATUS FOR CLEARING BEER.

Mr. R. W. Dickinson, of the Albany Brewery, Kent-road, has invented a very simple and efficacious apparatus for clearing beer while in a state of fermentation. The brightness of malt liquor depends principally upon the care taken in drawing off the yeast while the beer is working. After the wort has been sufficiently boiled with the proper quantity of hops, it is usually run off into coolers, and when its temperature has been by that means sufficiently lowered, it is transferred to a large vessel called a gyle tun. In this vessel, after being mixed with yeast, it undergoes the process of fermentation, and before that is complete, is removed into barrels placed side by side on racks, their bung-holes being left open for the yeast, as it rises, to discharge itself, which runs down into a trough placed below to receive it. It is necessary to watch this operation when the beer is in barrels, and to fill up frequently with fresh liquor, to supply the place of that discharged by the fermentation, that the vessel may be always nearly full. The improved method supersedes all this trouble and attention, and the beer works in vessels in which it is stored, supplying itself with fresh liquor in place of the yeast discharged, and always keeping the barrel full.

It is proposed to place all the barrels upright, and having filled them with wort previously boiled, and mixed with the proper quantity of yeast, a pewter pipe, perhaps six or eight inches high, is to be inserted into the bung-hole in the upper end of the barrel, and packed sound, so as not to leak. On the top of each barrel a small tub is to be placed, with a hole in its bottom, through which the pewter pipe is to rise, being securely packed also to prevent leaking, and then into the tub about as much wort is to be poured as will fill up the space in the barrel likely to be emptied by the discharge of yeast. The fermentation going on causes the yeast to rise up the pewter pipe into the tub above, and to supply the vacuity so formed in the barrel below, the fresh liquor in the tub is allowed to run through a small hole in the side of the pewter pipe near its bottom, by which means the barrel is always kept full of beer, and the yeast is received into the tub above.

It is the opinion of Mr. Dickinson, that by the adoption of such an apparatus he saves about one and a half per cent. in quantity, and the beer is by these means greatly improved: he also supersedes the use of a gyle tun, and saves the expense and loss occasioned by transferring the liquor from one barrel to another.

The Society of Arts have voted to Mr. Dickinson their silver medal for this invention.

* * *

IMPROVED CHUCKS FOR LATHES.

Edward Speer, Esq. of New Inn, London, has presented to the Society of Arts, a simple mode of constructing chucks, which he conceives will be found of great advantage to the practical turner. His chuck consists of a succession of hollow truncated cones fitting into each other, the outer one screwing on to the mandril of the lathe like a common chuck. These hollow cones adhere together by the closeness of their fitting, and the recess of the inner cone holds the end of the article to be turned, which is made fast in it by screwing up the pivot at the opposite end. This kind of chuck is calculated to obviate the necessity of numerous chucks of different sizes, as it is only necessary to remove so many of the cones as will leave a hollow sufficient to receive the end of the article. Every one acquainted with turning is aware of the trouble attendant on the fitting a piece of wood to the lathe, which by this contrivance is entirely obviated.

The chuck is as well calculated for turning brass or iron, as wood, and other soft substances; and it possesses one advantage which is peculiar to itself, *viz.* it is nearly impossible to injure the turning tool, should it come against a knot, for the friction of the chuck would by such obstruction be overcome, and the cones would slide round one within the other, that is, if the force was not too great by which they were pressed together, and this can always be diminished or increased at pleasure by moving the screw in the back poppit of the lathe.

The cones of the chucks are proposed to be turned at an angle of about ten or twelve degrees to the axis. Cones made of iron and of brass have been tried by the inventor formed in the same way, but they are not only expensive, but do not answer so well as wood, owing to their surfaces being too smooth; this, however, might be remedied by roughing: but, under all circumstances, wood is to be preferred, as they can be made at trifling expense, and possess sufficient strength—indeed more than can possibly be required in such lathes.

IMPROVED METHOD OF GENERATING STEAM.

To JAMES M'CURDY, *late of New York, United States of America, but now of Snow Hill, in the City of London, Esq. in consequence of a communication made to him by a certain Foreigner, for an Improved Method of Generating Steam.*

[Sealed 15th June, 1824.]

THE object of this invention is to produce steam for the working of a steam engine, without employing a boiler. The method adopted is, by injecting water into a red hot chamber, where it instantly becomes steam of high pressure, and escapes by a suitable pipe to the induction aperture of the engine.

This mode of producing steam may be effected by apparatus under such a variety of forms, that the patentee has not thought fit to exhibit any, but states that the subject of the patent may be considered under three heads; first, the construction of a hot chamber, in which steam may be generated by the injecting either hot or cold water; secondly, in equallizing the distribution of the water over every part of the chamber; and thirdly, in charging the chamber with a head or body of steam ready to start the engine.

The generator is proposed to be made of wrought or cast iron, in a cylindrical form, from six to twelve feet long, according to circumstances, with closed ends, which is to be built into a furnace and heated to redness. At one end a small tube is to be inserted, and carried through the whole length of the cylinder; this tube must be perforated with small holes, through which the water may be forced from a reservoir without, by means of a forcing pump, to be worked by hand, or by an attachment to the engine. By these means, the injected water will be made to spirt from the holes of the tube in every direction, and, coming against the heated surface of the cylinder, will immediately flash into steam.

At any convenient part of the cylinder, a pipe may be inserted for the purpose of conducting this steam away to the engine, and the aperture through which the steam passes may be closed with a loaded valve, so that the steam shall only pass off to the engine when it has reached a certain high pressure. In commencing the working of the engine, therefore, it is only necessary to put the force pump in action, when a sufficient quantity of high pressure steam will soon be formed within the chamber to start the engine, and every stroke of the pump injecting a fresh supply of water, the force will be kept up as long as the pump continues going. It is considered that half a gill of water will produce a sufficient quantity of steam to exert a power equal to four or five horses.

The prominent advantages contemplated by this invention, when applied to work a steam engine, are, a diminution in the first cost of the steam apparatus, as a large and expensive boiler is dispensed with; a great saving is likewise effected in the weight of the steam generator, and also in the room occupied, as well as in the consumption of fuel, which is particularly desirable when a steam engine is to be adapted to propel a vessel on water, or a carriage on land. The perfect exemption from danger is another very important consideration which the plan is said to insure; and lastly, the simplicity, strength, and durability of the apparatus is a farther recommendation to its adoption. As the plan proposed necessarily confines the magnitude and power of the steam chamber, or generator, within certain limits, it is intended, when very great power is required, to combine several of these generators in one furnace, or to erect several furnaces with such generators near together, and to bring the steam pipes into union, so as to supply one engine.

The specification concludes by saying that the claims of the patentee are, "First, for converting water, either warm or cold, direct from the reservoir that supplies the forcing pump instantly into steam of any required pressure, and in sufficient quantities to drive the engine, without the use of any boiler under pressure. Secondly, the mode or method of distributing the water through every part of the steam chamber, so as to diminish as little as practicable the action of the fire upon the steam chamber. Thirdly, for creating a head of steam, by charging the steam chamber previous to starting, and without the use of the engine."

[Inrolled, December, 1824.]

PROCESS FOR TINNING COPPER AND OTHER VESSELS, IN A DURABLE MANNER.

That copper and brass vessels cannot be used with safety in cooking victuals, or for holding articles of food, and particularly those which contain acids, is well known. It is also well known that the tinning applied in the usual manner is not durable, being soon worn away by cleaning, and on that account must be frequently renewed. Some, therefore, have proposed enamelling for kitchen utensils of copper, which, indeed, would answer exceedingly well, and be much safer for the health than impure tin mixed with lead, often employed for tinning, but, unfortunately, enamel is too dear, and readily breaks when the vessel receives the least blow, which cannot always be avoided.

The following process for tinning is attended with no danger from poisonous ingredients, as no lead is used in it; the tinning, too, is exceedingly durable, adds strength to the copper vessel, and secures it from the action of acids much longer than the common tinning:—When the vessel has been prepared and cleaned in the usual manner, it must be roughened on the inside by being beat on a rough anvil, in order that the tinning may hold better, and be more intimately connected with the copper. The process of tinning must then be begun with perfectly pure grained tin, having an addition of sal-ammoniac instead of the common colophonium. Over this tinning, which must cover the copper in an even and uniform manner throughout, a second harder coat must be applied, as the first forms only a kind of medium for connecting the second with the copper. For this second tinning you employ pure grained tin mixed with zinc in the proportion of two to three, which must be applied also with sal-ammoniac smooth and even, so that the lower stratum may be entirely covered with it.

This coating, which, by the addition of the zinc, becomes pretty hard and solid, is then to be hammered with a smoothing-hammer, after it has been properly rubbed and scowered with chalk and water, by which means it becomes more solid, and acquires a smooth compact surface.

Vessels and utensils may be tinned in this manner on both sides. In this case, after being exposed to a sufficient heat, they must be dipped in the fluid tin, by which means both sides will be tinned at the same time.

As this tinning is exceedingly durable, and has a beautiful colour, which it always retains, it may be employed for various kinds of metal instruments and vessels which it may be necessary to secure from rust.

Another durable, though somewhat expensive, method of Tinning.

This tinning, which consists of more articles and is dearer than the former, can be applied to metals and metallic mixtures, and, when well prepared, is exceedingly durable, which makes up in some measure for the cost. It is as follows:—Take pure grained tin one pound; good malleable iron one ounce and a half; platina one dram; silver twenty-four grains; and gold three grains. These five metals must be well fused together in a crucible with one ounce of pounded borax, and two ounces of pounded glass, and the liquid matter must be formed into small ingots. These ingots are to be again heated and reduced to powder in a warm mortar with a hot pestle. This powder is then to be put in an iron pan over the fire, where it must be again fused, stirring it well round: it is then to be poured into small flat moulds, where it is suffered to cool, and it is then fit for use.

This tinning is to be applied in the following manner:—First tin the vessel with grained tin and sal-ammoniac in the common manner; clean and scower this coating; then apply the composition with sal-ammoniac, according to the usual process, and when it is well diffused, suffer the vessel and the tinning to cool. Then expose it every where to a gentle heat to render the adhesion stronger, and immerse it while hot into cold water to give it that hardness and solidity which it had lost by being heated. The surface is somewhat rough and gritty; but you then rub it hard with a scratch-brush; and in order to make it even, you afterwards smooth it completely with fine sand, or any polishing ingredient.

If one coating does not appear sufficient, a second, and even a third, may be applied in the manner above described. Two coatings, however, are fully sufficient for kitchen utensils which have been a good deal used; and, if you wish to have the surface perfectly smooth and even, you may apply a thin coating of tin, which will fill up all the cavities, and render it quite even. A coal fire is the best for this tinning; for turf coals attack the metal, and interrupt the union and fusion of the coating.

ON DR. DARWIN'S "PHYTOLOGIA; OR, ESSAY ON THE PRINCIPLES OF VEGETATION."

The Botanic Garden and Zoonomia, by Dr. Darwin, are two noble monuments of fancy, industry, and science. In one we have almost the first instance of the happy application of poetry to illustrate and embellish the physical branches of philosophy. The other is, to say the least of it, a vast collection of the most curiously interesting facts, physiological and pathognomical, in the history of human life, as well as of many of the most ingeniously conceived theories which have been proposed to combine those facts into systems, the foundations of practical rules.

In his Phytologia, the same author, with a flow of fancy and sentiment nearly similar to that in his other works, in the same ornate, yet clear, easy, and natural style, in the same characteristic method of assembling facts, deducing inferences, and suggesting analogies, applies himself to explain the physiology of vegetables; to trace the chemical relations between vegetating bodies and the surrounding substances from which they are nourished; and then to deduce a system of rules for the improvement of the art of the gardener and the practice of the husbandman.

The readers of the Botanic Garden may perhaps have supposed, that, in the tale of the Loves of the Plants, the author intended only to dignify and animate his account of the theory of Linnæus by a happy and beautiful poetic fiction. But they have mistaken his purpose, and his botanical creed, who have thus conceived of them. He was never in his life more in earnest than in ascribing to vegetables the sensations, the affections, the passions, and even the designs of which we, ordinary mortals, believe animals alone to be capable. In fact, it was one of his favourite opinions, that plants are truly animals. This opinion he strenuously labours, throughout the physiological part of his Phytologia, to illustrate and to prove. The seeds of plants he easily shows to resemble the ova of animals. He discovers in the structure of vegetables, umbilical vessels perfectly similar to those by which embryon and nascent animals derive nourishment from the parent body, or from that store with which the wisdom of Nature involves them in the egg. He traces in the vegetable structure systems of absorbents, glands, and blood-vessels. He regards the leaves as lungs. He discovers the organs and the exercise in these beings, of the most exquisite sensibility. His facts were partly assembled from the works of almost all former writers on the physiology of vegetables, and, in part, the results of experiments ingeniously contrived and skilfully performed by himself. He suggested many pleasing and specious analogies, and here and there exhibited some clear and accurate deductions of new philosophical truths. If we must, with reluctance, own that he does not present to our minds sufficient evidence of that full and perfect similarity which he supposed between the structure and functions of vegetables and those of animals; it is, however, at the same time certain, that he opened several fine veins of physiological research, and that some of his novel positions, though not by himself satisfactorily proved, are such that they may possibly receive complete proof hereafter.

In the second part of this work he examined the chemical relations between the organized matter of vegetables, and the nutriment from which it is, by the vegetative functions, elaborated. He followed, with respect, the authorities of Priestley, Ingenhouz, Kirwin, and other eminent writers upon the application of chemistry to the subjects of gardening and agriculture. He trusted, however, as we should judge, much too implicitly to the facts of Young, Marshall, and other authors, whose publications on agricultural subjects, however popular, and however, in some respects, useful, contain few or no facts of such precision and authenticity that a philosopher can prudently take them for data, without first verifying them by his own observations and experiments. Dr. Darwin was yet more successful in explaining the chemical influences of soils, airs, water, temperature, and light, on the growth of plants, than in the establishment of his theory of their physiology.—But in this chemical part of his work, he was content to repeat the principles and opinions of others, without presuming to propose any important new theory of his own.

The rules for the practice of the gardener and husbandman, which he deduced as the results from both his chemical and his physiological researches, are partly dispersed through the previous divisions of the work, and partly assembled together towards the close. They bespeak ingenuity and good sense, but do not sufficiently wear the air of a practical acquaintance with farming, combined with accurate science.

Throughout the work are scattered some curious disquisitions on subjects allied, indeed, to the primary design, but not entering directly and unavoidably into it.

MISCELLANIES.

Heliotrope.—Professor Gauss of Gottingen, having remarked, while making some trigonometrical observations, that the light of the sun reflected by a window was visible at the distance of seven miles, was induced to make some experiments, by which he ascertained, that a small mirror, not more than two or three inches in diameter, would reflect the sun's rays ten German miles, or even more. This discovery will be found of great importance in measuring large triangles, as the method now adopted is to fix, at night, several Argand lamps, with reflectors, at the place which is intended to be observed at a great distance. In consequence of what he had observed, the professor constructed an instrument, which he has named the heliotrope; this has not only been found to answer its intended purpose exceedingly well in making the trigonometrical observations, but also to obviate the inconvenience of pursuing these operations by night.

Origin of the Bat's Wing Gas Burner.—This excellent method of producing a large light with a small expenditure of gas, was discovered by accident, and shows the trivial circumstances from which the greatest improvements often arise. A brass-founder who wished to exhibit to a friend the production of gas on a small scale, when it first came into use, had at hand only a burner, whose hole had accidentally been stopped up; and not having any instrument at the time to unstop it, he in haste took hold of a saw which lay by him, and made a cross cut through the hole. When this was tried, he found to his great joy, that it produced the most brilliant effect; and being a collector of animals, he instantly compared it to the wing of a bat, which name the burner has kept ever since. His friends were anxious he should secure an interest in it by a patent, but he generously gave it to the trade at large.

The Spider.—Of all the insect tribes which come beneath the bane of vulgar prejudice, this is assuredly the most curious. First, the Barbary spider, which is as big as a man's thumb. This singular creature carries its children in a bag like a gipsy. During their nonage the young folks reside there altogether, coming out occasionally for recreation. In requital for this kindness on the part of their nurse, the young spiders, when they are full grown, become mortal foes to the parent, attack her with violence, and if they are conquerors, dispose of the body as a fit subject for their next meal. Then there is the American spider, (covered all over with hair, which is so large as to be able to destroy small birds, and afterwards devour them:) and also the common spider, whose body looks like a couple of peninsulas with a little isthmus (its back) between.

Europe furnishes two instances of the existence of spiders, which may justly compete with those described by our transatlantic brethren. It is said that the sexton of the church of St. Eustace, at Paris, was surprised at very often discovering a certain lamp extinct in the morning. The oil appeared always to be regularly consumed. He sat up several nights in order to discover the cause of its mysterious disappearance. At last he saw a spider of enormous dimensions come down the chain, or cord, and drink up all the oil. A spider of vast size was also seen in the year 1751, in the cathedral church of Milan. It was observed to feed on the oil of the lamp. It was killed, when it weighed four pounds! and afterwards sent to the Imperial Museum at Vienna.

On the Depression of the Horizon at Sea.—It was observed by Captain Gautier, whilst engaged in making hydrographical observations in the Mediterranean, that the actual depression of the horizon did not agree with that calculated according to the height of the eye above the level of the sea. After an immense number of observations, it appeared that the excess of the calculated above the observed depression, had amounted to 3′ 31″ in the Mediterranean, and to 3′ 35″ in the Black Sea, whilst the contrary error had never amounted to more than 1′ 49″. Other observations, made by Captain Hall, gave 1′ 2″ for the excess of the calculated over the observed depression, and 2′ 58″ for the limit of the contrary errors. It appears from these observations that a knowledge of the thermometrical state of the sea and the air is insufficient to determine upon which side these errors will incline, and still more to calculate them. It appears, therefore, that it is necessary always to observe the distances of a star from two opposite points of the horizon, when the latitude at sea is to be determined to the accuracy of even a minute. The sum of the two altitudes—190°, will be the double of the depression, as the circumstances which determine it must be nearly the same all round the observer.

On the influence of the Earth on Meteorological Phenomena.—A new and very curious theory of the phenomena of meteorology has lately been advanced by several German philosophers; the author of it is, we believe, M. Meinecke. He supposes, from the known porosity of all mineral bodies, (metals, perhaps, alone excepted,) that the pressure of the external atmosphere will necessarily force its particles to a great depth in the earth. And he calculates, according to the admitted law of densities, that the weight of the incumbent air is sufficient at no very great distance below the surface, to render the density of the air, at that depth, greater than that of water. He therefore supposes that the atmospheric air exists in a fluid state at a certain distance below the earth's surface. The expansion and contraction produced by the vicissitudes of heat and cold, will occasion an evolution of air from the interior, or an absorption from the surface. In this manner he supposes the various changes of the weight of the atmosphere to be produced, as well as the winds; the density of the air at any place depending chiefly, according to this theory, upon the facility with which the strata beneath it allow the passage of the aerial fluid. This hypothesis is undoubtedly new and ingenious; it requires, however, far more extended inquiries than those which have been made by M. Meinecke, before it can be entitled to the belief of metereologists.

Tokai Wine.—The village of Tokai is situated on the top of a mountain, at the confluence of the river Bogdrog, with the Tisbisque, or Thesis. The inhabitants are Hungarian protestants, and Greeks originally from Turkey. This district was, about two hundred years ago, the theatre of constant wars, during which period the fortress which defended the post was so completely destroyed, that not a vestige of it at present remains. The vineyards are all to the west of the Bogdrog, and extend to the northward, occupying a space of ten square miles, interrupted by plains, on which are situated the villages of Tertia, Mada, Tarezal, Syombor, Benye, and Toleswa. The wine of Tertia and Tarezal is better than that of Tokai, but it is sold for less. This vineyard is situated about 48° north latitude. The soil is composed of a yellow chalk, mixed with large stones of a calcareous nature. The most esteemed vines are exposed to the south, on the steepest declivities of the mountain. Lord Montague is said to have been so fond of this wine, that, some years prior to his death, he travelled expressly from London to Tokai, in order that he might select the best of its produce.

The vineyards of Tokai furnish a sufficiency of wine to supply the opulent of Hungary, Austria, Poland, and Russia. The Emperor of Austria, the prince of Trantzon, and the college of Jesuits at Ungwar, possess the best cantons.

The wines of Tokai are white, and the vintage takes place extremely late: it commonly commences at the end of October, but occasionally not until Martinmas. Four sorts of wine are made at Tokai, to which they give the names of essence, anspruch, masslasch, and common wine. The first is made by placing picked grapes in a vintage tub, the bottom of which is perforated in various places, and pressing the fruit until all the juice is discharged; the expressed juice of other grapes is then poured upon the mass, and the whole trodden down: the wine is then put into small casks and exposed to the air for the space of a month, after having suffered it to ferment for one or two days. This is the anspruch.

The masslasch is obtained by adding common *must* to the preceding, and pressing it with the hands. The ordinary wine is made by the common method with the perforated tub and press. It is the anspruch wine which is commonly exported under the name of Tokai wine. When it is good, it is of a silvery colour, oily appearance, and has a sweet, and at the same time a slightly astringent and aromatic earthy taste. This wine keeps for a long period, and is not fit to be drank until after three years. The common price of Tokai wine of the first quality, is from six to seven francs per bottle.

NOTICES TO CORRESPONDENTS.

R. H.; X.; An Engineer; Mr. John Hall of London; A Constant Reader; M. Campbell; and W. L. have been received.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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> "We are born with faculties and powers capable almost of any thing; such, at least, as would carry us farther than can be easily imagined; but it is only the exercise of those powers which gives us ability and skill, and leads us towards perfection."

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CHAPMAN'S PLAN FOR CONSUMING THE SMOKE OF STEAM BOILERS.

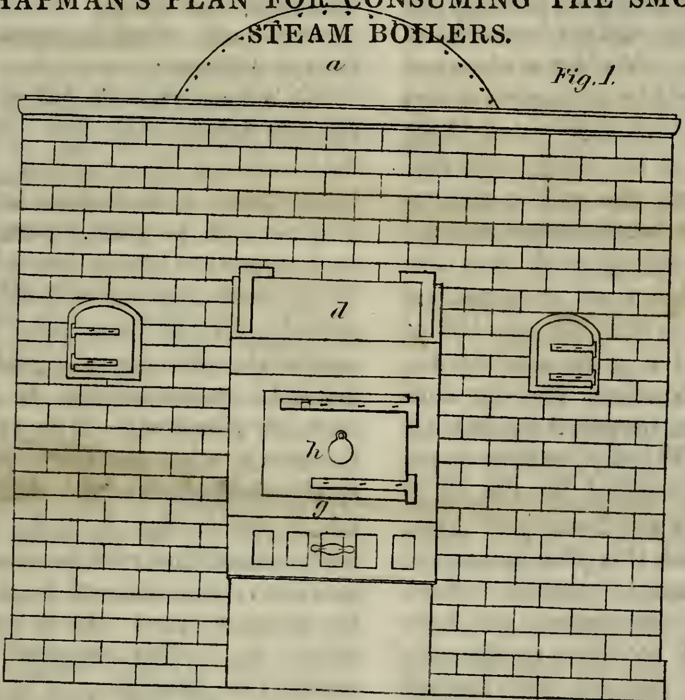
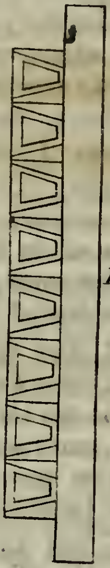


Fig.1.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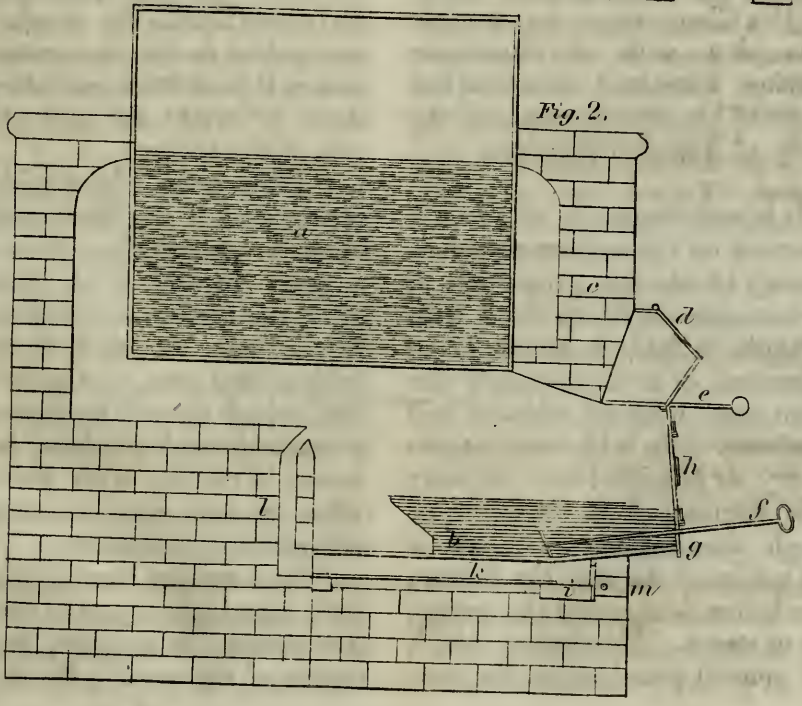
Fig. 2.

Swan Sc

MR. CHAPMAN'S PLAN FOR CONSUMING THE SMOKE OF STEAM BOILERS, &c.

It has long appeared very surprising that in Glasgow, a city which is not generally behind in objects of public utility or advantage, almost no attempt should have been made to burn the smoke of the numerous furnaces employed in and about the city for engines and the various branches of manufactures. We have observed with considerable pleasure, however, that within this short time, the propriety of adopting some method of burning the smoke and removing the nuisance thence arising, has begun to be agitated, and has become a subject of very general interest. In No. LXX., p. 181 of last volume, we gave a short account of an excellent plan for consuming smoke, invented by Mr. G. Chapman of Whitby, whose ingenuity was rewarded by the large silver medal of the Society of Arts; and as we think this plan one of the best and most efficacious which has yet been attempted, we have been induced to recur to the subject, and to present our readers with Mr. Chapman's own account of his plan, with an illustrative engraving, extracted from the last volume of the transactions of the Society of Arts and Sciences.

" It is well known to all that are conversant on the subject, that it is necessary to admit a proportion of pure atmospheric air, to unite with the smoke after it is generated in the furnace, in order to supply the oxygen gas, without which it will not inflame. It is likewise known that any air admitted into the body of the furnace, if it does not go through the burning fuel, has a great tendency to cool the bottom of the boiler, and retard the generation of steam. To obviate this, it is the general practice, in the construction of those furnaces which consume the smoke, to admit the air partly at the ash-pit, and partly up through the fire-bridge. I offer for the consideration of the Society an improved plan, which I have adopted, and which has answered beyond my utmost expectations. It is as follows:

" To heat the air before its admission into the furnace. This I do by casting the grate bars hollow from end to end, so that they form a series of parallel tubes, which open into two boxes, one placed in front, and the other behind the grate. In the front box, directly under the fire-door, I make a register to open and shut, to any extent, at pleasure. The other end I connect with the brick-work directly underneath the fire-bridge, which fire-bridge I make *double*, with a small interval between, say one inch; the interval to go across the furnace from side to side, and rather to incline forward, or towards the fire-door, so as to meet and reverberate the smoke on to the ignited fuel in the grate, which causes it to inflame and become a sheet of bright fire under the bottom of the boiler.

" From what I have said it will appear that if the front register is open, or partially so, there will be a great draught of air through it, along the interior of the grate bars, thence into the flue of the fire-bridge, and out of the orifice at top, which air will be heated in its passage through the bars, before it comes in contact with the smoke, when it will give out its oxygen, and cause it to inflame.

" Such was my view of this part of the subject in theory, and I have found it to succeed in practice, in a small engine of my own. But a further improvement was necessary to make it quite perfect. There are few people who are aware of the extent of the mischief arising from the old method of charging a grate by the front door. Now, in my engine, (which is only two-horse power,) I calculated that every time the fire-door was opened to stir the fire and replenish the fuel, there could not be less than from forty-five to fifty cubic feet of cold atmospherical air admitted into the furnace, which so cooled the heated gases, &c. that, however complete the plan was in other respects, the smoke could not possibly inflame, from being so cooled, till a considerable time after the fire-door was shut.

" To obviate this I have adopted a cast-iron hopper above the fire-door, with a type at the bottom that has two pivots at one side and opens at the other; one pivot goes through the end of the hopper and has a counter-lever to keep the type shut when a sufficient quantity of coal for a charge is on it. The top of the hopper is covered with a lid which I shut down during the time of firing, then, by lifting the lever which opens the type inside, the coals slide down on to the fore end of the grate bars, which is only the work of a moment. It is evident that no quantity of cold air can thus get into the furnace; in fact, it is not possible for any person that does not see the operation of firing to know when fresh fuel is added by looking at the top of the chimney. The smoke that issues is never more than a light grey, just perceptible, but in a general way is not seen at all.

" The coals last admitted, after lying a short time at the front of the more ignited fuel, become partially coked, and just before I admit a fresh supply, I push the last charge further along the grate, by a tool made for the purpose, which remains constantly in the furnace. It consists of a plate of iron about four inches broad; its length goes across the grate with a round bar of iron rivetted into its centre, at right angles, to form a handle, which comes through a hole made in the bottom of the fire-door, and is long enough for a man to use with both hands, so that he can either push from, or pull towards him, to manage the fire within, without opening the fire-door, except when the grate wants cleaning, &c. &c. For better knowing when the fire wants stirring, or replenishing, I have a hole, about an inch in diameter, in the fire-door, to look through, covered by a piece of iron which hangs by a rivet above.

" After I have used the above instrument, I pull it up close to the fire-door, where it remains till it is again wanted; and the coals, when let into the fire, fall down beyond it.

" The above-written account constitutes the whole of my improvements, as far as is required by the Society, but not the whole of the advantages gained by my invention. For instance, the durability of the grate-bars by the admission of air through them. I may add, that I examined my own yesterday, and I do not find them any worse, although they have been in use four months.

" N. B. I am perfectly aware that there are many plans of feeding furnaces by means of hoppers, yet I trust you will find my plan somewhat different; it is at least to what have fallen under my notice."

References to the Plate.

Fig. 1, an elevation.

Fig. 2, a section.

(The same letters refer to the same parts in both figures.)

a, the boiler.

b, the fire-place.

c, the feeding-hopper, with its cover, *d*, and its type, or turning bottom, with its lever and counterpoise, *e*, by means of which the coals are delivered into the fire-place.

f, a rake, by means of which the half burnt coals are pushed forward previously to letting in a fresh charge.

g, a slit below the furnace-door, through which the shaft of the rake passes.

h, an eye-hole in the furnace-door, through which the state of the fire is seen.

i, *i*, an air-tight box, into the back of which the bars open, and in front of which is a register for the admission of air.

k, one of the hollow bars, the whole of which are shown in fig. 3, as they open into the box, *i*, fig. 1.

l, a flue in the fire-bridge, through which the air, having passed first into the box, *i*, and thence through the hollow bars, *k*, passes into the furnace and consumes the smoke.

ON THE IMITATION OF THE GRECIAN ARTISTS IN PAINTING AND SCULPTURE.

No. II.

In our article in No. LXXXVI. (Vol. III.) we alluded to the uncommon beauty of figure, complexion, and bodily proportion of the Greeks, as a circumstance favourable to the imitative arts of painting and sculpture, and peculiarly adapted to render them interesting; but we must now observe that in the noble and virtuous freedom of the Grecian manners, there were a variety of circumstances that rendered these models of beauty peculiarly adapted to improve these arts. Had the Grecians adopted the manners of the Egyptians, who are said to be the inventors of many of the arts and sciences, and who, by the most austere laws, cramped and restrained nature in many of her operations, these models of beauty would not have produced the effects now under consideration, and select or beautiful nature would have been but very imperfectly discovered to the inquiring artist. But among this wonderful people, whose lives were devoted to elegant pleasure, and whose manners were not restrained by certain demands of decency, which seem to be but of modern origin, and owe their rise perhaps to our corruption, nature appeared without a veil, and disclosed all the variety of her graceful beauty.

The painters and sculptors studied their respective arts in those gymnasia, or public places, where the youth, who needed no other veil than public chastity, and purity of manners, performed, quite naked, their various exercises. These places were frequented both by philosophers and artists. Socrates came hither to instruct Charmides, Antolychus, or Lysis; and it was here also that Phidias came to contemplate, in these living, active, and animated models, the beautiful, graceful, and sublime. In these public exercises all the different motions of the muscles, and an amazing variety of postures and attitudes were exhibited to the view of the attentive observer; and the contours of a beautiful and vigorous body were sometimes visible in the impressions which the young wrestlers made upon the sand of the arena.

It may easily be imagined that these individuals appeared in an infinite variety of situations and aspects in these exercises; and possessing a dignity, truth, grace, and expression which can never be found in those mercenary models that sell their ignoble nakedness to the painters and sculptors in our modern academies.

The soul alone can imprint upon the body the character and expression of truth; an attitude that is not formed by feeling, is a falsehood —a counterfeit. A painter who is desirous of expressing in his designs this character of truth, can never succeed, if he has not before his eyes attitudes animated by sentiment, or does not supply this by the power of a lively and well directed imagination.

The flower of the youth danced naked at Athens on the public theatre. It was the great Sophocles that gave the first example of this singular spectacle to his fellow-citizens in his youthful days. At the feasts celebrated by the Eleusinians in honour of Ceres, Phryne, the beautiful Phryne, appeared bathing to the eyes of all Greece; and when she came out of the bath, she probably gave the sculptors the model of the sea-born Venus. At Sparta, the young damsels danced naked on a certain day in presence of all the Spartan youth; and this will not appear so surprising when we consider, that in the primitive ages of the Christian Church, persons of both sexes were baptized indiscriminately, by immersion in the same water.

From all this it appears, not only that Greece furnished the noblest and most graceful models for perfecting the arts now under consideration, but that the painters and sculptors had, from the turn of Grecian manners, and the nature of their public institutions, the best possible opportunities of deriving from these models all the instruction they were adapted to administer. These opportunities returned constantly with their shows, games, and festivals, which were very numerous.

Hitherto, indeed, we have only considered the advantages the Grecian artists enjoyed, with respect to the graceful, the beautiful, and the noble, of which the public spectacles presented them with perpetual models. The objects that excite sorrow and terror are, however, essentially comprehended in the imitative arts, and the terrible and the moving are necessary branches of the sublime in painting. The Greeks, while they remained free, were too humane to admit scenes of blood or spectacles of horror in their theatres. Some allege, indeed, that spectacles of this kind were not entirely unknown in Ionia; it is, however, certain, that if they really were introduced into that province, they were but a very short time in vogue. Antiochus Epiphanes, king of Syria, was the first who introduced these scenes of horror into Greece. He sent to Rome for gladiators. Those unhappy victims of the barbarity of a fierce populace, were at first extremely displeasing to the Greeks, who beheld them with horror: but this sensibility gradually diminished; custom rendered these inhuman scenes familiar; and thus they exhibited a new set of objects to exercise the pencil and the chisel of the Grecian artists; a new set of objects, and a new source of instruction. It was here that Ctesilas found the model of his dying gladiator, that astonishing masterpiece of expression.

These multiplied occasions of observing nature in all her motions, and in all her various aspects, not only rendered the Grecian artists capable of representing her various beauties with energy and truth, but also encouraged them to go yet farther than real nature, and to make a new step towards perfection, under the guidance of those very principles which nature had furnished them with. After contemplating nature in her fairest forms, they imagined forms yet more fair and striking: they thus acquired ideas of beauty superior to those nature herself had exhibited, and these they applied to the particular parts of the human body in their noble productions, and also to the whole, taken in one point of view. This ideal beauty had no existence but in their elevated conceptions; it was not derived from any external object, but it far surpassed any thing which had hitherto passed for beauty in the esteem of mankind.

It was from this ideal form of beauty, that Raphael drew his famous Galatea. This immortal artist, in his letter to Count Balthazar Castiglione, observes, that the different branches of true beauty are rarely united in one person, particularly in those of the fair sex; and that, of consequence, he judged proper to give his Galatea the sublime lines of an ideal beauty, and to work after a model which existed no where but in his own imagination.

These ideas, which are really superior to all the ordinary forms that matter assumes in the ordinary course of things, guided the Grecian artists in their representations both of gods and men. In the statues of the gods and goddesses, the forehead and the nose were almost entirely comprehended in the same line.

We find a profile of the same nature in the heads of the celebrated women of ancient times that are represented in the Grecian medals, though it was by no means a matter of indifference here to follow or depart from this ideal plan. It is possible that this confirmation may have been peculiar to the ancient Greeks, as flat noses are to the Calmucks and some other nations, and little eyes to the Chinese. The large full eyes that we always find in the Grecian heads in the ancient gems and medals, seem to form a strong presumptive argument in favour of this opinion. Be that as it may, the Grecian artists drew the heads of the Roman empresses after the ideal model also; and thus we find the style and manner that reign in the profile of a Livia and an Agrippina, to be much the same with those that are observable in that of an Artemisia or a Cleopatra.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION III.—*continued.*

Recovery of Alkali from waste leys.

It is a very bad practice among bleachers, and it is almost universal, to use again and again the alkaline leys, which must be loaded with impurity: they are often so much so, indeed, as to approach to coagulation. They are led to this from a notion of economy, being unwilling to throw away any alkali which they can any way employ. But it would often be more economical to purify the ley before using it, and a method of doing this is also a desideratum for procuring fresh alkali from leys which can no longer be used. Several plans for this purpose have been suggested, but few have been successful, or, at least, economical. Des Charmes advises the residual ashes to be moistened with the ley, and burned in a common kitchen fire, in which wood is the usual fuel. He also recommends boiling the waste leys with quicklime, which is found to be one of the best ways of management, as the lime decomposes the impure vegetable matter floating in the leys, and renders them transparent and caustic, though not altogether so pure as fresh made ley. (See Art of Bleach. p. 558.) This is chiefly practicable, however, when the leys have been used for cottons; for the resinous extract of linens is not so easily acted on by the lime, without adding, along with the lime, as may easily be done, a small quantity of the fresh precipitated earth of alum. The mixture should be constantly agitated during the process, in order to expose every particle of the resinous and extractive matter to the action of the lime. Des Charmes in this gives directions quite opposite from those practised by the bleachers around Glasgow. They find that the lime acts better in a cold solution than with the addition of heat. (See Ramsay's Treatise.) Another mode is by calcining the waste leys in a reverberating furnace, or in the apparatus called the stone boiler, already described; and by these means alkali can thus be obtained purer than that which is imported; which, in extensive bleach-works that can afford the expense of the apparatus, is of great consequence. The ley is first evaporated till it becomes of the consistence of treacle, (see Des Charmes, p. 92,) when it is put into the furnace or boiler, where, being dried, it takes fire and burns vividly. The mass is thus melted, and is found to consist of pure alkali; for all the resin and extractive matter is completely consumed, and the carbon formerly taken up from the cloth reduces the sulphate of potash to the state of a carbonate, and this carbon is again taken up by the quicklime used to render it caustic, so that it is nearly in a state of purity. If boilers are used, their safety should be insured by the ingenious method recommended by Mr. Ramsay of Glasgow. (See Ann. of Philos. I. 258.)

The home manufacture of alkalies, is but slightly connected with the direct subject of the sketch, yet I cannot help remarking that it ought to be carefully attended to. We are indebted to Spain for an annual supply of several thousand tons of barilla, and to America and Russia for incalculable quantities of pot and pearl ashes, while we possess considerable resources at home, which are either altogether neglected, or ignorantly and unskillfully managed. The French, with the most laudable spirit of industry and enterprize, take advantage of their wine leys to prepare an ash (Œndre Gravelées) from the leys of wine, which contains no less than 60 or 70 per cent. of pure alkali, (Des Charmes, p. 279.) We cannot, indeed, for want of material, produce this alkali; but let us turn to account the resources we possess. Let endeavours be made to improve the kelp manufacture by constructing proper furnaces for its combustion, and by preparing the sea weeds whence it is to be made, according to well ascertained chemical principles. Let the furze, broom, and fern, which grow in such great abundance in some of our waste lands, be turned into potash, or let such plants as best afford alkali be cultivated expressly for its manufacture. The tansey (Tancetum vulg. Lin.) is, according to Lord Dundonald, one of those; and as it grows in abundance in a wild state on the banks of Clyde, it is highly probable that its cultivation would be extremely easy. Potash may be procured from saltpetre, by heating it with charcoal, so as to decompose its acid. In this way, we are told by Parkes, that one hundred weight of the nitre will produce half that quantity of pure potash. During our late disputes with America, a great quantity of saltpetre was used for this very purpose; and when the prices will admit of it, considerable profit may in this way be gained. Potash may also be made from peat ashes.

ON GRAFTING FRUIT TREES.

4.—*Root Grafting.*

The next method of grafting fruit trees is *root grafting*, which I shall now proceed to describe.

This is performed by whip grafting the scion upon a stock, formed merely of a piece of smooth root, cut from a tree of the same genus. The piece of root may be six or seven inches long; should be clean and smooth, and of the same diameter as the scion. The length of the scion may be five or six inches. Let them be united by whip grafting, bound together with bass, and well protected with a coat of composition over the joint, so as to prevent the wet from affecting the wounded parts. In planting them, the root and half the graft should be buried. Under this course the scion itself will root.

After two or three years, if it be thought proper to have the graft sustain itself on its own root, the stock may be quite cut away. The above is an improved method, and is said to preserve in the graft a nearer similitude to the parent. It is certainly an expeditious way of obtaining a new plant. But such a graft cannot be materially different from a cutting or layer, and cannot be expected to include the full advantage desirable from a vigorous seedling stock.

C. D.

Woodside, 24th August, 1825.

METHOD USED IN GERMANY FOR POLISHING WOOD.

In the first place, the Germans are careful to join their wood very neatly, and to make the surface very smooth, because if the varnish brings out the beauty of the wood, it does the same by the defects. When the wood is once well polished, they prepare the varnish.

For this purpose they reduce to a powder some of the purest shell lac—that is to say, very transparent, and dissolve it in well-rectified spirits of wine; they add, in a retort, double the quantity of alcohol to the lac employed, and expose it to a heat of about fifty degrees Reaumur. They are careful to agitate the mixture every three hours, until the varnish has acquired the suitable consistence; if it does not appear of a sufficient consistence, they add a little more pulverised lac; if on the contrary it is too thick, they mix a little more alcohol, being careful to agitate the mixture until it is of the right thickness.

This varnish has no peculiar quality, except that it contains no turpentine, nor any other body that renders the varnish gluey, and liable to crack.

They apply the varnish with a piece of fine linen, which is formed into a sort of pallet. The workman is previously provided with a mixture of two parts of varnish to one of olive oil, in which he soaks the linen, and then rubs it over the surface of the wood with great force, and pressing very hard upon it, but always in the direction of the fibres of the wood.

He begins afresh by moistening the wood again, until the whole surface of the wood is covered with a slight coat of varnish. When the wood is well moistened with the varnish, they leave it to dry, which it does very quickly, and they then apply a second coat, a third, and even a fourth if necessary. When the varnish is perfectly dry and hard, they give it the lustre in the following manner:

They steep a piece of fine linen in a mixture of olive oil and tripoli reduced to powder, and rub the wood hard with it until the varnish has acquired the proper degree of brilliancy. Then to give it the last polish, they rub it with a piece of very soft linen, or very fine soft leather.

This varnish may also be applied with a brush, on bodies that do not offer an even surface, only it must then be made thinner by adding a greater proportion of alcohol. It may afterwards be polished in the manner above described.

When it is applied to bodies of great surface, it is essential that the varnish be made as thin as for bodies in relief, because as it dries quickly, the edges of the parts that are first laid on would acquire a degree of thickness, which could not be reduced in the polishing.

Lastly, articles that are turned in wood, may be varnished and polished in the same manner even in the lathe.

The only inconvenience attending this varnish is, that it gives the wood a brownish colour, which is no inconvenience where a deep colour is desired; and for which reason it is much used in varnishing mahogany and the walnut and cherry-tree woods. But when the wood is to be kept of a light colour, the varnish is made in the same manner, only instead of the lac, they use copal gum dissolved in the alcohol, adding to it sometimes a little camphor or ether. This varnish may be applied with success to many different sorts of wood.

Some of the Vienna makers dissolve the copal by exposing it to the action of the vapour of alcohol, and sometimes they colour the copal varnish, which is naturally colourless, with any tint they may wish to give it; and they do not seem to use any spirits of turpentine to dissolve the copal.

By this method of applying varnish to wood, it penetrates so completely into the grain that it is almost impossible to crack it. So that when scraped, even with a sharp instrument, if the traces be not very deep, the polish may be restored by hard rubbing with a soft piece of linen.

The gluey varnishes have not this advantage, since they do not penetrate so deep into the substance of the wood, and a scratch will take them almost clean off, in such a manner that no friction will restore the polish.

DUNFERMLINE SCHOOL OF ARTS.

We have been favoured with a copy of the following Regulations, which are proposed for the Dunfermline School of Arts, and we gladly give them our entire approbation. We are extremely happy to see that there is here a provision for admitting persons to the use of the library, whether they wish to attend the lectures or not. This is a great advantage, particularly in a small town where there are very often few opportunities of obtaining books otherwise, and where, consequently, the benefits of the Institution are entirely shut out from all those who do not subscribe to the lectures.

REGULATIONS.

I. That the Institution shall be called, The Dunfermline School of Arts, established for instructing Tradesmen and others in such branches of Scientific and Mechanical Philosophy, as are of practical application in the exercise of the arts of life.

II. That Subscribers of four shillings a year or upwards, paid in advance or at two successive quarterly instalments, shall be Members of the Institution, and have a right to the use of the books in the Library; that a small additional sum, such as a working mechanic can reasonably afford, to be fixed by the Committee, shall be charged for admission to the lectures, with the exception of Members for life, and annual Subscribers to the amount of fifteen shillings and upwards, who shall be admitted to the lectures and the use of the library, gratis. That persons may subscribe either for the Lectures or the Library, as they find convenient; those only being eligible as Members of the Committee who subscribe for both.

III. A Donation of Three Guineas shall constitute a Member for life.

IV. That the books, apparatus, and other property that may be acquired by the Society, shall belong to the Donors and Members who have paid their subscription for the current year, but those who fail to do so, shall cease to be Members of the Institution, and shall have no claim whatever on its funds or property.

V. That the affairs of the Institution shall be managed by a Committee, chosen annually from among the Members for life and annual Subscribers; consisting of a President, Vice-President, and Fifteen Directors, including the Treasurer and Secretary, ten of whom shall be mechanics. Any four Members, with the Treasurer or Secretary, shall be a quorum.

VI. That three Members of the Committee shall go out annually, by lot, until a rotation of seniority be established; after which, the three at the head of the list shall retire, it being understood, that the President, Vice-President, Treasurer, and Secretary, may at any time be re-elected.

VII. That it shall be the province of the Committee to select and purchase books and apparatus, frame regulations for the Library, engage Lecturers, and transact all the business of the Society. They shall meet once every two months, or oftener if they see cause.

VIII. That a General Meeting of the Subscribers shall be held on the
for the purpose of receiving a report of the proceedings of the past year, with a statement of the receipts and expenditure of the funds, and to elect a Committee of Management for the ensuing year. A General Meeting of the Members may at any time be called by public notice, by a majority of the Committee.

XI. That none of the foregoing regulations, when approved of by a General Meeting, shall be altered, except by another General Meeting; and the Institution shall not at any time be dissolved, nor its funds nor property disposed of, without the concurrence of three-fourths of the Members at a General Meeting, specially called for the purpose by public notice, and individual written notification.

ON FORGE SCALES. By M. P. BERTHIER.

[From the Annales de Chimie.]

WHEN pieces of iron are heated to whiteness, in order to draw them out into bars, or roll them into plates, they become covered with a coat of oxide, which flakes off in scales by the blow of the hammer, or the pressure of the rollers.—These are called by the workmen forge scales.

The thickness of the forge scales is proportionate to the time that the masses of iron on which they are formed have remained in the fire, but commonly it is from one to two millimetres; (from $\frac{4}{100}$ to $\frac{8}{100}$ of an inch;) they are of a shining black colour, with a semi-metallic lustre; their structure is crystalline, and presents intersecting laminæ, perpendicular to the surface of the scales. They are said to have been observed distinctly crystallised, in regular octohedra.

They are usually composed of two parallel laminæ, the outer one granular and blebby, the inner compact and crystalline. This structure forbids a doubt of their being liquified at a certain period of their formation: nevertheless, although they become soft by an intense heat, we are unable to fuse them completely. It is probable that their fusion is effected by the local heat which is developed at the moment when the incandescent iron combines with the oxygen of the air, and which must necessarily be very intense; but as it is quickly dissipated, the matter soon becomes solid, and assumes a crystalline structure, if not cooled too suddenly. A similar phenomenon is seen in the combustion produced by striking fire with the flint and steel, in cupellation, and in several other instances.

The forge scales are very magnetic. When reduced to grains of the size of a pin's head, they adhere to a magnet like metallic iron. Their specific gravity is 3.5; but, as they always contain some blebby cavities, this must be too low. Their powder is of a dull greyish black colour.

This oxide has hitherto been supposed to be the same as the native magnetic oxide, and that obtained by passing aqueous vapour over iron heated to redness. Having had occasion for some very pure oxide of iron, for some experiments on the silicates of that metal, I used the forge scales, supposing them to be so; but I soon perceived that they do not contain so much oxygen as the magnetic oxide, which at present is considered as a *deutoxide*. For instance, when, for the purpose of preparing a protosilicate of iron, I employed calculated proportions of forge scales and iron filings, a certain portion of the metal always remained unoxidated: and when I reduced forge scales by cementation, in a black lead crucible, I constantly obtained a heavier button than the pure native oxide, similarly treated, would have given. I was therefore induced to inquire into the true composition of these scales; and the results of my experiments demonstrate, that they are a new oxide, which, from the quantity of its oxygen, ranks between the protoxide and the native magnetic oxide.

This oxide does not produce any peculiar salt; it is decomposed by the acids into protoxide and peroxide, exactly like the deutoxide, and this property affords a very simple method of analyzing it, and is the one which I adopted. I treated the forge scales with pure muriatic acid, in which they dissolve very readily, even in the cold, if the acid be concentrated, and the temperature of the liquor becomes considerably raised. I diluted the solution with water, and threw down the peroxide by gradually pouring in carbonate of ammonia till the liquid was discoloured. This process is not attended with any difficulty; it gave me from 0.34 to 0.36 of peroxide, according to the scales I employed, and which I obtained from different forges, both from the tilt-hammer and the flatting-mill. The purest gave the largest quantity of peroxide. When I only obtained .34, I always observed, at the moment of solution, a slight disengagement of hydrogen gas, which lasted only a few seconds, and evidently proceeded from some minute grains of metallic iron, accidentally mingled with the forge scales. The same scales assayed in the dry way with one-fifth of their weight of earthy glass, gave metallic buttons whose weight varied from 0.75 to 0.78. If we compare these results with those which an oxide composed of two atoms of protoxide, and one atom of peroxide would give, we find an almost perfect identity; for such an oxide would contain

Protoxide 0.642 — $2\,f^2$; or iron, 0.745 — 100
Peroxide 0.358 — F^3; or oxygen, 0.255 — 0.344.

I believe this, therefore, to be the true composition of the forge scales.

According to these results, we must henceforth reckon four oxides of iron, in which the quantities of oxygen combined with the same quantity of iron are respectively : : 6 : 7 : 8 : 9.

This oxide is formed whenever iron is in contact with a more oxygenated oxide at a white heat, or when heated in contact with the air, so as not completely to oxidate it.

It is necessary to observe, that some forge scales give, on analysis, much less than 0.35 of peroxide; but in that case they are not pure, but contain a mixture of scoriæ, which is discovered by the jelly it produces with concentrated acids. As these scoriæ are silicates of protoxide of iron with a great excess of base, the presence of from 0.02 to 0.05 of silica may diminish the proportion of peroxide nearly one-fifth. Perhaps it may be objected to my hypothesis of the composition of forge scales, that a mixture of deutoxide and metallic iron, or its protoxide, would give the same analytical results as those which I obtained with my presumed new oxide; but if the scales be such a mixture, it is very extraordinary that the ingredients should always be found in the same proportion; I shall, however, obviate these objections by the detail of some facts, which, in other respects also, I think are not uninteresting.

If the forge scales were a mixture of deutoxide of iron and metallic iron, they would contain 0.09 of the latter; but then their specific gravity would be much greater than it really is, since that of the deutoxide is more than 4.7, and that of iron 7.5. Moreover, when we treat a mixture of very fine iron filings and the pulverized deutoxide or peroxide, with muriatic acid, the iron dissolves before the oxide with evolution of hydrogen gas, and we find in the solution quite as much peroxide as there would have been without the admixture of the metallic iron. Hydrogen gas does not reduce this peroxide; now, since the forge scales contain one-half less of peroxide than of protoxide, we should admit, from that circumstance, that they contain half their weight of metallic iron, which it is impossible to suppose, since, when pure, they give no sensible quantity of hydrogen by the action of acids. Besides, if they contained half their weight of iron, they would give 0.85 of fused iron by the assay, which is far beyond what we obtain.

(*To be continued.*)

Statement of Claims to the Invention of the Process for Discharging Turkey-Red. By Mr. David Campbell.

Gentlemen,—After an interval of nine months, I observe that Mr. John Miller has made another effort to assert his claims to the invention of the discharging of Turkey-red cloth. This effort is futile and inaccurate to a remarkable, indeed pitiable extent; and I assure you, were there no more than the merit of the invention concerned, I would suffer his observations, on this occasion, to pass utterly unnoticed. But there is an attack upon my credit and character in his last observations, by his erroneous insinuations; and I hope you will allow me to notice these in the same Magazine that conveys the calumny. I will be very brief.

Mr. Miller's first remark is, that he began his discharging with Tennant & Knox's bleaching salt. But this statement clearly discovers, that he must have been posterior, in his first essays, to the invention and extensive practice at Blantyre, where the discharging was carried on long before the appearance of this salt; and that by means of Berthollet's liquor, which serves the purpose exactly, having the same chlorine acid, and is only less convenient than Tennant's salt, which is portable, by being done up into a powder. Since Miller, then, used no discharging matter till that powder came into use, he certainly was far behind the practice at Blantyre Works.

But this allusion to Berthollet's liquor, and Tennant's powder, is altogether a deception. For there is no merit due to him, or me, or any one, in the use of either; their powers being alike known to every one; and colour having been taken, by Berthollet's liquor, out of yarn long before: the whole merit being in the applying of Berthollet's liquor to the discharging of colour, after the form done at Blantyre, before Mr. Miller, or any one else, did or could use the salt he mentions.

How childish, then, is it for Mr. Miller to go on imagining, that I, not having this salt, could only sprinkle Berthollet's liquor on the dark Turkey-red pullicates with my finger, or with a broom! The absurdity here is, that Miller really does not know that I did the discharging in this ridiculous way; he only stupidly conjectures it; while the truth is, that I used Berthollet's liquor, before Tennant & Knox's powder came into use, precisely in the same way that either it or that powder is or may be used at this day. The whole difference, indeed, is only the greater convenience of the powder.

To demonstrate, however, that I did not carry on this process before he invented it, in any other form than in the bungling manner now noticed, Mr. Miller adds, "for he had no bandages, nor even a press of the construction I invented." This is just mere ignorance. For certainly, though I had neither his press, nor his bandages, in any sense I can understand the phrase, yet I had what was perfectly sufficient. I had, for instance, plates of block tin and lead, engraved with any figures I choosed; and a press much stronger than ever he invented, or his engineers constructed. Here, again, the press and bandages are forced into notice, purely for the purpose of deception. For there was no room for inventing a press at the time alluded to, as that mechanical power has been in extensive use for many centuries; and what, indeed, was Archimedes' screw? And as to bandages, no mechanic understands the term; and I profess to know nothing about it. But I know well what were Mr. Miller's attempts for a long time after the extensive use of the process at Blantyre. These were by forcing brass tubes or types into his cast-iron plates, which had two grievous imperfections; the one of only impressing on the cloth round holes or squares, as clubs or diamonds; the other of effectually both cutting and burning these spots like a riddle.

Never hesitating as to what he rashly says, Miller now observes, that I showed my ignorance in using tin. Now, I never used tin. I never said I did use it. But what I said I used, was a composition of block tin and lead, to give the lead consistency, and admit of a clear engraving; and yet Miller, with an obvious ignorance, or wish to impose, says I took only one of the compounds, and that the smallest, and one that by itself is of the least use, indeed of no avail, into my service! No; I amalgamated the tin with the lead, which made a perfect compound.

He pretends to talk about tin being destroyed by the liquor. But he had himself to learn that valuable lesson in the use of his brass tubes, or types, or may be bandages, if he means these; for the liquor most effectually destroyed these brass things, and gradually wore the cloth into holes. Mr. Miller, in fact, had much of his knowledge to learn since the discharging was in the utmost state of perfection, by other means than those of either tin plates, or brass tubes, or bandages.

But here comes the most trying assertion of all Mr. Miller's inventions, and one that must either establish his claim, or sink his pretensions for ever. This wonderful story is this: that so ill was I going on at Blantyre, that the Company ordered one of Mr. Miller's presses, made by Roberton, but that I could not work it either; so that M'Brain & Stenhouse were continued to discharge for the Company. Mark, then, all this boasting; and hear how it vanishes at the touch of a little truth. At the time Roberton's press was brought to Blantyre, and long before, the Company there were busily engaged, night and day, with ten presses at the discharging; and M'Brain & Stenhouse only then, and for some time, assisted in the farther supply. But after trials of this press, the Company found sufficient reason to pack it up and return it to its maker, as will be seen, not from my assertion, but from the following letter, the original of which is left at the shop of the Publisher of your Magazine for public inspection.

Glasgow, *2d Dec.* 1805.

Dear Sir,—Be sure on Wednesday to return that spotting press of Roberton's, and be sure to pack it carefully that no accident befal it, and let every part of it be in the same situation as when you got it; without this we shall be farther troubled, Roberton having called to-day, and said he did not think he was bound, it being so long in being returned; he however agreed again, if it was sent down on Wednesday.

I remain, dear Sir, Your's truly,

Adam Bogle.

Mr. D. Campbell, Blantyre Mills.

This letter is sufficiently humiliating, and requires no commentary from me, except to add, that we persevered in our own invented plates and presses, neither of which have been altered in their principle to this day, but admit of those beautiful patterns to be varied to infinity.

To be sure Miller adds what he calls a "proof" of his own rash story, by adding that, after my unsuccessful attempts, Mr. Rodger was sent to Glasgow. Poor man! how little he knows about the secrets of Blantyre Works! Mr. Rodger did not leave Blantyre till 1808, when the whole discharging apparatus was sent to Barrowfield. The reason of this removal was nothing more than the erection of a large mill at Blantyre, on the spot where the discharging apparatus stood.

The last device of this person to establish his claim, is rather unfortunate for him, as it is a sheer blunder. It is founded on the notion, that I could not have *lawfully* been discharging colour at the time I said, without an entry with the Excise, a license, and the measurement of every piece. But the truth is, that Mr. Miller knows nothing of the early history of this work. For the Excise laws were, at that time, in force only as to the printing of colour, and not as to the discharging of it, nor for two years afterwards, till a new law was made to include it.

Such is all Mr. Miller says; and his correspondents speak next in his behalf. As to these, then, they are all, but Moffat, who is a mere labourer, very humble mechanics, and speak the same instructed language; and how far they understand their own meaning, it is hard to say. They neither support their friend's claim, nor shake the authority of mine. But they contain several remarkable admissions against Mr. Miller's. First, not one of them brings up Mr. Miller's invention nearer than two years to the period when the discharging was in extensive operation at Blantyre. This is quite decisive of Mr. Miller's pretensions. Again; they all agree in describing the cast-iron plates which he used, to be set with types of brass in 1804; which proves two things—that the brass was destroyed by the liquor, and that the cloth, discharged by his means, was necessarily injured. Indeed this is not left to be conjectured; it was exactly the case; and, as a positive proof of it, large quantities, known not to belong to Mr. Monteith's process, returned from the continent, all out in holes, with such loud clamours, as nearly ruined the trade. Besides, these tubes, from their figure, could only impress round or square holes, and not those varied figures which the engraved surface plates, used from the first at Blantyre, finely executed. Indeed the best proof of the futility of Miller's inventions is, that there is nothing in use like them at the present day; all that is now done, being precisely similar in principle to the original invention at Blantyre.

I have only to add, that Jeffrey perverts every principal fact in his pretended history of the work. The discharging process was never given up for a moment at Blantyre, till, as said before, in 1808; when it was removed to Barrowfield, for the reason already given. It is not true either, that M'Callum was put to the warping; never having had his hand at that employment: but being sent to Barrowfield in that year, with the discharging apparatus, where he continued till shortly before his death. At his departure from Barrowfield, I furnished him with a certificate of his character and abilities. And so far from my being also removed, as is insinuated, I remained at Blantyre till 1814; having had five successive contracts with four brothers of this respectable Company, of seven years endurance each; which renders it extremely unlikely that I was the ignorant individual, in this important and extensive undertaking, that Mr. Miller, in his ignorance, would fain insinuate.

I am, Gentlemen,
Your obedient Servant,
David Campbell.

Glasgow, 14th August, 1825.

LETTERS AND QUERIES.

Gentlemen,—I have often, and I dare say every one must have observed, that on a stick or stone being thrust into the bottom of a stagnant pool of water, a series of bubbles come to the surface. If a tumbler full of these bubbles be collected, which can easily be done by touching the bottom of any stagnant pond with a stick, and at the same time holding an inverted tumbler, previously filled with water as if collecting gas, on the surface, and held to a lighted taper, the contents will explode. These bubbles are undoubtedly a gas of some kind; and I should like very much to hear if its qualities be ascertained.

Your Correspondent J. W.'s enquiry into the cause of bells being formed and remaining under water, (in a Query in No. LXXX. of your Magazine,) brought the above fact to my recollection. I have no doubt the bells spoken of by him may contain a similar substance to that of the stagnant water bells.

Should the above be worthy of a place in your useful work, some of your able Correspondents may favour us with a few lines showing both the cause and qualities of the above mentioned substance.

I am, yours, &c.
D. B.

Glasgow, 14th July, 1825.

Gentlemen,—I coincide with your friend A. B. that there would be impropriety in devoting many pages of your useful Magazine to long scientific discussions, because your labours, I presume, are not principally devoted to give information to the scientific mechanic, such as the City of Glasgow abounds with. Your various Institutions give a facility, or key to knowledge, of which few other places can boast. In Towns and Villages, where such assistance cannot be obtained, the child in learning is thankful to profit by your medium of information, which, in my humble opinion, should occasionally explain, or put into common numbers, even the simple illustrations of your scientific friend at Dollar. If he, or any other person, would take the trouble, after having shown his ability in the sciences as an algebraist, to put his formulæ arithmetically in a succeeding Number of your work, using the common tables of sines, tangents, &c., I am sure that many would profit by such condescension. Few operative mechanics in this part of the kingdom know, that a period, or full stop, used in punctuation, signifies that the adjuncts should be multiplied together; as in No. LXIX. page 165, that the $\sin a = 2 \sin \frac{1}{2} a \, . \, \cos \frac{1}{2} a = 2 \surd$, &c. &c. Now, as you profess to address yourselves to *the multitude of operatives* who thirst for useful information, permit me, as one of your readers and admirers, to request that you, or some of your numerous scientific friends, would occasionally favour those readers who desire to gain information, with a popular method of solving questions, otherwise hard to be understood, in a similar manner to what you have graciously done in No. LXVIII. p. 148.

I am, yours respectfully,

X.

Sunderland, August, 1825.

[We shall pay attention to this friendly hint. Our great desire is to make our work useful and intelligible to the class of persons for whom it is more immediately intended, and we do think we have already improved this from what it at one time was. However, we are never against advice, when we think it well meant.]

Gentlemen,—In your first volume is a communication from Dr. Stucco, on a mode of hardening Plaster of Paris busts. I have seen it practised, but the following method is, I think, still better. Give your bust a thorough soaking in boiled linseed oil, and when dry, repeat this. After the second coat is dry, wash it all over with copal varnish; 1-4th part of turpentine, mixed with the oil, will keep it from assuming that greasy appearance it would otherwise do. A fine specimen of a phrenological bust done in this manner, may be seen at present at Lyle the chemist's, in Hutcheson-Street.

Yours, &c.

W. L.

QUERY.

A Gentleman in the neighbourhood, who has to dispose of a water power of 28 feet fall, and which is situated only seven miles from Glasgow, producing, at the lowest calculation, 1000 cubic yards of water per hour, is desirous of knowing how many horse power such a water fall is equal to.

R. H.

USEFUL RECEIPTS.

Method of making a Pellicle composed of Milk and Vinegar, which may be used in Writing, Printing, &c.—This pellicle is obtained by the mixture of two parts of milk with one of vinegar, which is exposed to a degree of heat sufficient to coagulate the milk. The liquor is then filtered through paper, and produces an acid which is tolerably strong, and perfectly colourless.

This vinegar retains its transparency and limpidity until the eight day; it then becomes turbid; it clears again after some days, but not perfectly, and precipitating a whitish sediment; the liquor then acquires an appearance similar to whey, not well clarified. The twelfth day, certain filaments form on the surface, which adhere to the sides of the vessel, and converge to the centre until they form but a single body.

From that time the substance acquires a degree of consistence, and before the thirtieth day, is as thick as about twenty-two millimetres and a half. In this state it is taken out of the vessel, and spread upon paper to dry. This substance, which is nearly six lines thick, becomes, as it dries, thinner than gold beaters' skin, and cannot be broken without force. It sticks so hard to the paper that it would tear, if the paper were not moistened when it is detached from it.

This pellicle being insoluble in water at any temperature, unalterable in the air, and resisting many agents and re-agents, appears to be susceptible of application to various purposes. It bears characters of writing and printing; its transparency renders it proper for covering pictures and other valuable objects, it may also be used for tracing, and instead of fine parchment; but in dry weather it will hardly fold without breaking.—*Bulletin de Pharmacie.*

NOTICES TO CORRESPONDENTS.

We have neither time nor room to notice all our friends this week, so they must just rest satisfied till next week.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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THE GLASGOW MECHANICS' MAGAZINE,

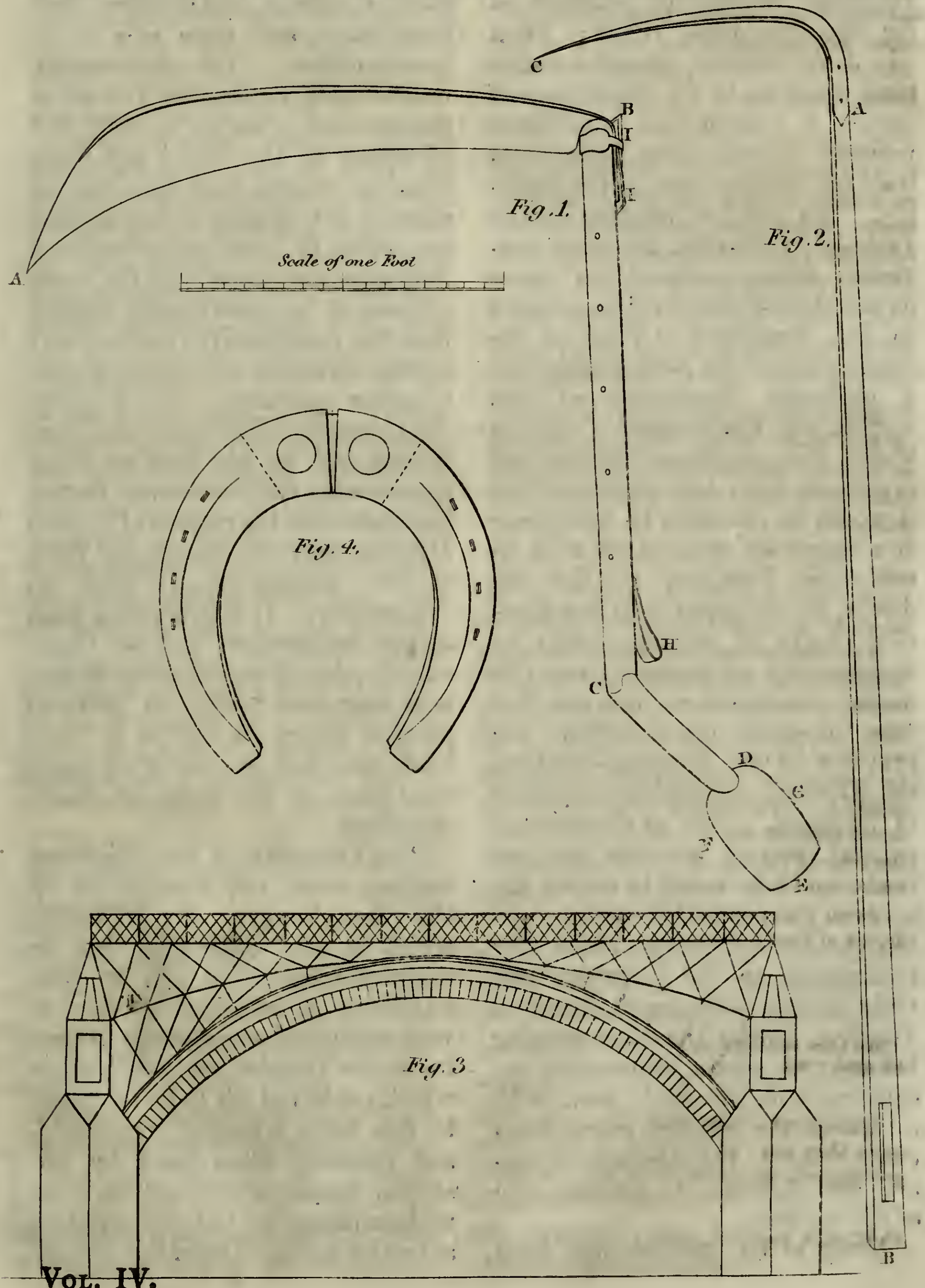
CONDUCTED BY

A Committee of Civil Engineers and Practical Mechanics.

> " Our days we have not spent in toys, or lust, or wine;
> But in search of deep Philosophy,
> Wit, Eloquence, and Poesy:
> Arts which we love, for there the mind can shine."

No. XC. *Saturday*, 10*th September*, 1825. Price 3*d*.

HAINAULT SCYTHE; EXPANSION TABLET HORSE SHOE, &c.



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HAINAULT SCYTHE.

The subject of the Hainault Scythe having excited considerable interest at present, we present our readers with an engraving, and an account of it extracted from the Farmer's Magazine of August last. This instrument was brought under the notice of the Directors of the Highland Society of Scotland so far back as June, 1823; when Mr. J. A. Murray, advocate, called their attention to the importance of having a comparative trial made between it and those implements used for reaping corn in this country. At another meeting on the 15th July following, the same gentleman having reduced his views on the subject into writing, referred to Mr. Ratcliffe's "View of the Agriculture of the Netherlands," for a particular description of this scythe, and the favourable opinion which that intelligent author had expressed of it; and suggested that it would be desirable to bring over two labourers acquainted with its use from Flanders, so that its merits, as compared with our common modes of reaping, might be satisfactorily ascertained; and this matter, he observed, was one that very properly came within the province of the Highland Society, the General Agricultural Society of Scotland. But as the summer general meeting was now past, no funds could be voted to defray the necessary expense that season; and the Directors, therefore, could only recommend to the Members and their friends who might travel in Flanders during the then ensuing harvest, to obtain information respecting it on the spot; and, with a view to the ulterior proceedings contemplated, the Depute-Secretary was directed to procure two of the scythes.

Many of our readers must have heard of the trials made several years ago with the Hainault Scythe on the farm of Mudiford, near Christ-church, belonging to Sir George H. Rose. This gentleman had employed a Flemish labourer, a prisoner of war, to teach his people the use of it; and some of them, it appears, had acquired great proficiency, and were able to instruct others. The first experiments were reported in the newspapers, and attracted a good deal of notice at the time; and yet it does not appear that this had the effect of introducing it into general use even in that neighbourhood. Whatever may have been the cause of this, it is nevertheless certain, that its comparative merits were neither unknown nor unappreciated in other quarters. Mr. Warden, Sir George's bailiff, after this gentleman had let his farm on being appointed to the Embassy at Berlin, had instructed the reapers of Colonel Hughes, near St. Asaph, and those of Sir Watkin W. Wynne, at Wynnestay. It appears also, from recent information, that the Hainault Scythe, if not in common use, is at least well known in different parts of Wales, as well as of England, and that it was tried some time back as far north as Aberdeenshire.

The Directors of the Highland Society were not ignorant of all this; but, knowing the difficulties which a new implement has to encounter before it can be subjected to a sufficient number of well conducted experiments to have its merits decided on,—difficulties which could not fail to be increased by this being a foreign implement, and probably often used by unskillful hands, they resolved, notwithstanding, to put the question at rest by having it tried in a variety of situations, and with the different kinds of crops, and that these trials should not be confined to one or two districts, but made throughout most of the corn counties of Scotland, under the inspection of the local agricultural societies. Such an arrangement, it is evident, was well calculated to make the merits of the implement extensively known, and, at the same time, to afford an opportunity to the labourers of almost every part of Scotland to learn how to work with it.

With the same laudable care to obtain decisive results from the proposed experiments, it was resolved to act upon the suggestion of Mr. Murray, to bring over labourers from Flanders, rather than employ those at home, who were said to have been instructed by the Fleming who introduced it on Sir G. H. Rose's farm. Mr. Warden himself had offered his services to the Highland Society early in the autumn of 1823 and been in correspondence with Sir John Sinclair on the subject. Mr. Charles Gordon, the Depute-Secretary, had also procured two of the scythes. These, with Mr. Warden's correspondence, were laid before a meeting of the Directors in November that year, and the whole matter remitted to a committee, with a view to experiments being made in harvest 1824. The committee very properly reported that it would be preferable to have Flemish labourers, as the full knowledge of the implement might be relied on, and hence their instructions would probably be better attended to. Their report was brought up and approved of in July 1824.

Early in last autumn, Mr. Charles Gordon, the Depute-Secretary, who is ever indefatigable in carrying into effect the patriotic objects of the Society, chose to relax a little by making a tour on the continent, and was to have engaged labourers to come over to Scotland, if he had reached Flanders in time; but before he got to Antwerp, the harvest was nearly over in the Netherlands, and too far advanced in this country to admit of this being done.

We have mentioned these particulars to show that the Highland Society having spared no pains to procure proper hands, the greater reliance may be placed on the trials now in progress.

At last, through the kind offices of M. the Chevalier Masclet, Consul of France, two hands, the sons of small farmers, were engaged in French Flanders, and brought over at the expense of the Society. They arrived at Edinburgh on the 12th ultimo; on the 15th they were employed in reaping with the Hainault Scythe on the farm of Lochend, belonging to Mr. Oliver, in the neighbourhood of the city, before a great concourse of spectators; and the day following they set out on the route assigned them by the Society, through East Lothian, and the counties of Berwick and Roxburgh, practising one or two days near the principal towns. On the 22d they were at Dalkeith, from whence they were to proceed to Lanarkshire, Renfrewshire, the Carses of Stirling and Gowrie, and the counties of Fife, Forfar, Aberdeen, and Moray, and perhaps still farther north if the duration of the harvest will admit of it.

Before leaving Edinburgh, every necessary arrangement, we understand, was made for the comfort of these two foreigners, both of them persons of very respectable appearance, as well as for having the trial, made in the most public manner, and before the most competent judges. On this point, great praise is due to our worthy correspondent, M. Masclet, who volunteered to accompany the reapers, and set out with them accordingly. To say nothing of his services as an interpreter, the urbanity of his manners, and his disinterested zeal for the improvement of our agriculture, must secure to them, as well as to himself, a favourable reception everywhere. The Members of the Highland Society, abounding in every part of Scotland, and most of them, at this season, in the country. were to attend the trials in the several districts; while the local Agricultural Societies have entered into the measure with a degree of spirit and liberality, (having offered, of their own accord, to relieve the Highland Society from part of the general expense,) which have not often been equalled, and which are to be found, to the same extent, and among the same class, in no other country than Britain. Still further to insure accurate and full reports, the Highland Society have circulated printed queries, to direct the attention of those who attend the trials to the most important circumstances. Their Reports, which are to be laid before the Society in November, will determine to what extent, if any, or in what circumstances, the Hainault Scythe may be advantageously adopted in Scotland.

Notices of the trials, so far as they have proceeded, have already appeared in the newspapers; and we have been favoured with communications from several farmers of great respectability, who witnessed the experiments.

The trial made at Lochend on the 15th need not detain us, as the implement has since been subjected to more satisfactory experiments, in various situations. The best account of these we have seen, down to the exhibition near Dalkeith, on the 22d and 23d, is given in a provincial paper, (the Kelso Mail,) which describes the trials in East Lothian, Berwickshire, and Roxburghshire, that is, in the best cultivated counties in Scotland, in the following terms:

"On the 16th and 17th the use of the instrument was exhibited on the farm of Amisfield Mains, near Haddington, in presence of the Marquis of Tweeddale, the Earl of Lauderdale, Mr. Hay of Spot, Mr. Hunter of Thurston, Mr. Balfour of Whittinghame, Mr. Rennie of Phantassie, Mr. Bogue of Woodhall, and many of the most eminent agriculturists in East Lothian; and we have been favoured by an intelligent spectator with the following account, accompanied by a few remarks:

"The first trial was made upon a field of strong wheat, and in two hours and a half the reapers cut down about a quarter of a Scots acre, though they were somewhat interrupted with stones. This trial satisfied the gentlemen present, that where land is free of stones, two reapers with the Hainault Scythe might cut an acre of strong corn in a day, and that it will be cut closer, and with as little loss in shaking, as with the common sickle. On the second day the reapers cut some barley and oats, and though the superiority of the implement was not so evident as on the first occasion, (the corn being much lighter on the ground,) it was on the whole very satisfactory. They finished by another trial in the wheat field.

"There appeared some difference of opinion as to the advantage of using this implement on all occasions, but there was only one opinion as to its decided superiority in cutting strong standing corn. Care must be taken, however, to clear the land of stones; and where this is done, the crop will be cut closer, and as clean, with the Hainault Scythe, as it can be by the modes practised in this country, and at considerably less expense.

"On the evening of the 17th the party proceeded to Dunse; and next day exhibited in a field of barley belonging to Mr. Logan of Crumstain, in the presence of General Maitland, Mr. Hay of Dunse Castle, and a number of the most respectable farmers in the neighbourhood. The barley was a heavy crop; and in an hour the two reapers cut 606 square yards, equal to one-eighth of an English acre, or at the rate of one acre three-eighths in a day of eleven hours. Those who witnessed the work stated that it would require five of their best Irish reapers to cut the same quantity in the same time. This trial gave great satisfaction, and several gentlemen took immediate steps to enable some of their workmen to employ the scythe.

"Having arrived at Kelso on the evening of the 18th, arrangements were made for a short trial next day, to suit the convenience of farmers attending the market; whilst Saturday, the 20th, was set apart for putting the abilities of the reapers to a full and fair test. Accordingly, on Friday afternoon, the use of the instrument was exhibited for about an hour, on Mr. Dudgeon's farm of Spylaw, to a very great concourse of spectators, all of whom appeared to take a most lively interest in the scene, and to derive much satisfaction from it. Next day the reapers were again upon the same ground about ten o'clock, and proceeded to work an hour on a very heavy crop of barley. They cut 726 square yards, which, on a day's work of ten hours, is at the rate of three-fourths of an English acre to each reaper. The ground was rather stony, and some impediment from the crowd was unavoidably sustained, otherwise, as asserted by the reapers, they would have done at the rate of an acre each at least. At first several binders tied and set up the sheaves; thereafter one man undertook the task, and performed it; but he declared he could not have gone on throughout the day, and it was evidently too much for one of the best workers to accomplish. The next trial took place upon some very light oats, and it certainly proved that the scythe was quite effectual on crops of that description, a fact which was very generally doubted. As there happened to be no wheat ready for cutting on Spylaw, the next and third trial was made upon a field of wheat near Kelso; a very fair crop, and the ground free from large stones. The day being far spent, the time was limited to a quarter of an hour, and the result was 212 yards, or at the rate of one acre and three-fourths, English measure, per day of ten working hours; and here again the obstructions from the crowd were very considerable. The whole corn taken down was cut closer to the ground, and cleaner, than by the sickle. Three of the *best* reapers, with the sickle, cut an English acre per day, making also bands for the sheaves; but five are often found scarcely equal to the same work.

"These experiments were witnessed by a Committee of the Highland Society, a Committee of the Union Agricultural Society, and a number of proprietors and eminent agriculturists; and, at intervals, a number of intelligent and active workers, who had been brought forward for the purpose, were allowed to use the scythes, and received instructions from the Flemings; and many of them showed considerable expertness.

"The two young Flemings are sons of farmers in *French Flanders,* (where farms seldom much exceed 100 acres,) and their names are J. B. Dupré and Luis Catteau, the first from the neighbourhood of Douay, the other from near Lille. Their behaviour is modest and unassuming; they are very intelligent, and show a most praiseworthy anxiety for information, particularly in satistical and agricultural matters, on which they take numerous notes. They allege they cannot do so much work as the labourers in their own country, who depend solely for subsistence on their daily toil. To a question pointedly put to them, if the scythe could be used with advantage when the crop was on an acclivity? They unhesitatingly replied, 'Equally well as on a level piece of ground;' and offered to prove it.

"After the labours of the day, the Members of the Union Agricultural Society gave a dinner at the Cross Keys Inn, in honour of the Chevalier Masclet, to which, with his consent, MM. Dupré and Catteau were invited; and the evening was spent in useful discussion and agreeable festivity.

"The Committees we have mentioned are, severally, to report to the Highland Society, and we shall not attempt to anticipate the decision they may come to. We shall simply remark, that, whilst from the description of the surface of the country, and from our climate, the Hainault Scythe can never be brought in so as to supersede the use of the sickle, (were it even desirable to do so,) it may, and if fairly tried, we have no doubt, will become a very useful auxiliary to our other modes of 'gathering together the *crops* of the earth.'

"We understand it is the intention of the Members of the Union Society, to offer premiums of three, two, and one guineas, for the best reapers with the Flemish Scythe, to be determined next harvest; a plan which, if followed by other Societies, will soon put the instrument to a speedy and general test, amply sufficient to settle the question of its utility."

Description of the Plate.

This implement, called in England the Hainault Scythe, is known in French Flanders under the name of *Piquet*, or *Petite Faulx*, (small scythe.)

It is composed of two parts, fig. 1 and 2. Fig. 1 represents the *Piquet*. The blade, A to B, is 21 inches long, and $2\frac{7}{8}$ inches broad. The back is $\frac{2}{8}$ of an inch thick.

The blade is fixed into the handle by one, or rather two wedges, I, I, I.

The handle from I to C, is 17 inches long. At C it is curved; the length from C to D, $5\frac{1}{2}$ inches.

The part F, G, E, is, from F to G, $3\frac{1}{8}$ inches wide, and from D to E, 4 inches long. This serves as a balance, and to help the workman.

At H, is a small leather strap, in which the workman inserts his fore-finger. In this point, where they place their fore-finger, is the centre of gravity.

Fig. 2 is called the *Crochet* (the hook.) The workman uses it with his left hand to gather the quantity of corn he intends to cut, to support it when he is cutting, and lay it afterwards behind him.

This hook has a handle, A, B, of the length of 3 feet 5 inches: its shape is square: it has at the top an iron hook nailed on the wood: its length from A to C is $10\frac{6}{8}$ inches.

The small opening above B is for the purpose of inserting the blade, so as to prevent the workman being hurt, when carrying his implement.

* * *

IMPROVED ARCH FOR THE ADDITIONS TO THE OLD BRIDGE.

Gentlemen,—There are, perhaps, none of the late improvements in the city and suburbs of Glasgow of more importance than the widening of the old bridge. But it is to be regretted that there has existed, more or less, a feeling of insecurity, which at least diminishes the comfort this improvement would otherwise have afforded. Whether this idea of danger be well or ill founded, I do not pretend to determine, though it is probable that the foot-way is, in some parts, sustained more by the mere strength of the materials, than by the strength peculiar to an arch. If the annexed plan of an additional improvement were adopted by those who have the management of such matters, it would, I think, give both the idea and reality of safety. It would not be very costly, would harmonize as well with the other parts as if it had been part of the original design, and would add greatly to the elegance of the whole.

It will be understood by inspecting fig. 3 of the plate, without any particular reference. It consists of a cast-iron segment, concentric with each stone arch, resting, like the others, on the abutments, and touching the flat arches at the middle. It might either be a simple rim of cast-iron, as it appears on the right hand side of the fig., or the space between the latter and the present flat arch might be filled up with a very slight fret work, as appears on the left side. The doubling of the pavement now going on, is certainly a very necessary addition, considering that a long thin stone, supported only at the ends would soon get very weak in the middle, from the continual wear; but it is apparent that as it strengthens it on the one hand, it weakens it on the other, and by increasing the weight on the flat arch, must increase the danger above alluded to, and render the improvement which I now propose the more necessary.

I am, yours, &c.

Glasgow, 31st August, 1825. G. M.

EXPANSION TABLET HORSE SHOE.

Gentlemen,—Being solicited by Samuel Davy, veterinary smith of the Edgeware Road, in whose welfare I take a considerable interest, to write you about the Expansion Horse Shoe, (one of which accompanies this letter,) I feel it necessary to enter into a short account of it.

About twenty-five years ago, I became sceptical to the generally prevailing idea that horses' feet were naturally subject to disease. Soon after, I got acquainted with Mr. Bracy Clark, veterinary surgeon, whose mind was awakened to the same subject. We communicated together; and, after various inquiries and researches, became not only satisfied that the work of nature in horses' feet was no more neglected than in any other of her sublime operations, but that the cause inducing a premature decay in these animals was the application of an inelastic ring as a protection to a part intended for elastic action.

I tried a shoe with a joint, and having used it, (with many objections,) for twelve months, I communicated the results to Mr. Bracy Clark; and as great benefits had been experienced by the animal on whom these shoes had been used, notwithstanding their unfitness for general experience, he, with his accustomed perseverance, set about planning the present expansion shoe. Mr. Clark is a surgeon, and not a smith; consequently, though invented six years ago, they have never been well made till lately,—*i. e.* about eighteen months past, during which period they have been manufactured by Samuel Davy, who, becoming convinced of the mischief done by the OLD *system*, is about giving up all his common work, and entirely devoting himself to the NEW;—a sacrifice, (for the moment,) which I trust your notice of him will call forth an ample reward for.

I am the only person who has firmly continued the jointed shoes from the first using them, now more than ten years! the last five or six years being devoted to the expansion tablet shoe, from the use of which I have known and experienced much mischief, till Davy became the manufacturer of them; since which they have been without fault. The charge for them is more than for the common shoe at first; but as they will bear new tablets being put to them twice, they become in the end more economical than the old fashioned sort, which I do not hesitate to say, I would not have put upon a horse of mine for one hundred pounds!!

As the making of the tablet expansion shoe requires particular tools, I advise the sending up of an intelligent man from every principal place to Davy, to learn both to make the shoes and the tools: and I think he ought to have a compliment of ten guineas for each pupil. The new shoe affords ease, health, and longevity to the horses; and safety to their riders.

Hoping I shall have been of use by this letter, to a very deserving man, with a large family,

I am, yours, &c.

John Hall.

[We have given an engraving of this horse shoe, (see fig. 4,) and would strongly recommend that it should be tried by some of our smiths. The shoe itself may be seen by calling at our publisher's. Mr. Davy, Mr. Clark, and Mr. Hall, all deserve the highest thanks for their perseverance in attempting to remedy this evil which has so long afflicted so useful a class of animals; and we trust that Mr. Davy will receive, what he is fully entitled to, a more substantial reward for his labours. We should suppose that inspecting the engraving will at once show the peculiarity of this shoe, which, having a joint in the middle, allows of sufficient expansion to meet the action of the foot.]

COMMERCIAL POWER OF GREAT BRITAIN.*

This is one of the few books written by foreigners, giving a correct account of this country, so far as it treats, and which, therefore, ought to be prized accordingly. Its author, the celebrated Baron Dupin, one of the greatest engineers France has produced, visited this country in 1817, and seems to have been struck by the power and wealth which it exhibits.—Instead, however, of viewing this with the mean and jealous eyes which some have done, and amusing his countrymen with the foibles and follies of the national character, he determined to investigate the causes of this extraordinary power; and by pointing them out to Frenchmen, lead them, if possible, to follow that course which with us had produced such effects. In the ardent admiration, therefore, with which he has viewed our institutions; the indefatigable manner in which he has studied them; and the enthusiastic manner in which he has written in their praise, he has been actuated but by one motive—the glory and aggrandisement of his own country. We hope his object will be obtained, and that he will succeed in pointing out to his countrymen the true road to commercial greatness. We have no mean or jealous fears on this head; we are not among those who always see in the advancement of our neighbours the degradation of ourselves. A true knowledge of political economy will yet show that the advancement of any nation must be beneficial rather than hurtful to those around it; and that inter-national commerce must increase, and new sources of wealth be unfolded to all, as nations advance in civilization and improvement.

The spectacle presented by Britain seems to him unexampled in the history of nations. From her naval power, her empire might be said to extend over the world. "In Europe it borders, at once, towards the north, upon Denmark, upon Germany, upon Holland, upon France; towards the south, upon Spain, upon Sicily, upon Italy, upon Western Turkey. It holds the keys of the Adriatic and the Mediterranean; it commands the mouth of the Black Sea, as well as of the Baltic. No sooner had its navy, the arbiter of the Archipelago, ceased to be adverse to the cause of Greece, than, on the instant, the ports of the Peloponnesus found new liberators in the posterity of the Heraclides; and from Corinth to Tenedos, the sea which leads to the Bosphorus, became, to the descendants of the Argonauts, the road to victory, and to a second and a richer golden fleece—national independence! In Europe the British empire permits this conquest.

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* The Commercial Power of Great Britain; exhibiting a complete View of the Public Works of this Country, under the several Heads of Streets, Roads, Canals, Aqueducts, Bridges, Coasts, and Maritime Ports. By the Baron Dupin. London; Charles Wright.

"In America, it gives boundaries to Russia towards the pole, and to the United States towards the temperate regions. Under the torrid zone, it reigns in the midst of the Antilles, encircles the Gulph of Mexico, till at last it meets those new States which it was the first to free from their dependence on their mother-country, to make them more surely dependent upon their own commercial industry; and, at the same time, to scare, in either hemisphere, any mortal who might endeavour to snatch the heavenly fire of its genius, or the secret of its conquests; it holds, midway between Africa and America, and on the road which connects Europe with Asia, that rock to which it chained the Prometheus of the modern world.

"In Africa, from the centre of that island, devoted, of yore, under the symbol of the cross, to the safety of every Christian flag, the British Empire enforces from the Barbary States that respect which they pay to no other power. From the foot of the Pillars of Hercules, it carries dread into the remotest provinces of Morocco. On the shores of the Atlantic, it has built the forts of the Gold Coast, and of the Lion Mountain. It is from thence that it strikes the prey which the black furnish to the European, races of men; and it is there that it attaches to the evil the freedmen whom it snatches from the trade as slaves. On the same continent, beyond the tropics, and at the nearest point to the Austral pole, it has possessed itself of a shelter under the very cape of storms. Where the Spaniards and Portuguese thought only of securing a port for their ships to touch at; where the Dutch perceived no capabilities beyond those of a plantation; it is now establishing the colony of a second British people, and uniting English activity with Batavian patience; at this moment it is extending around the Cape, the boundaries of a settlement which will increase in the south of Africa to the size of those states which it hath founded in the north of America. From this new focus of action and of conquest, it casts its eyes towards India; it discovers —it seizes the stations of the most importance to its commercial progress, and thus renders itself the exclusive ruler over the passes of Africa from the east of another hemisphere.

"Finally, as much dreaded in the Persian Gulph, and the Erythrean Sea, as in the Pacific Ocean and the Indian Archipelago; the British Empire, the possessor of the finest countries of the East, beholds its factors reign over eighty millions of subjects. The conquests of its merchants in Asia begin where those of Alexander ceased, and where the terminus of the Romans could never reach. At this moment, from the banks of the Indus to the frontiers of China, from the mouths of the Ganges to the mountains of Thibet; all acknowledge the sway of a mercantile company, shut up in a narrow street of the city of London!

"Thus, from one centre, by the vigour of its institutions, and the advanced state of its civil and military arts, an island, which, in the oceanic Archipelago, would scarcely be ranked in the third class, makes the effect of its industry and the weight of its power to be felt in every extremity of the four divisions of the globe; while at the same time it is peopling and civilizing a fifth, which will follow its laws, will speak its language, and will adopt its manners, with its trade, its arts, its cultivation, and its enlightenment!"

Such is the exalted picture which this enlightened Frenchman draws of our country; his object in the work before us is to ascertain the causes of this greatness, and in this we shall follow him in our next Number.

LEVERN MECHANICS' INSTITUTION.

THE inhabitants of Barrhead and Neilston, anxious to follow the bright example of so many of their neighbours, and to form a Mechanics' Institution, after several preliminary meetings in Mr. Anderson's Inn, Arthurlie, met on the evening of Tuesday the 10th August, in Mr. Cowan's Hall, Barrhead. About a hundred individuals were present at this meeting; and of these, seventy subscribed to become members of the Institution, agreeing to pay 7*s.* 6*d.* each.

The following Committee of Management was appointed, *viz.*

Messrs. Matthew Shanks, Dunterlie, Preses; Duncan Stewart, Neilston, Treasurer; and John Allan, Gateside, Clerk.

For the Neilston district, Messrs. D. Stewart, William Cochran, and Arthur Renfrew; for Crofthead, Messrs. William Buchanan and John Robertson; for Gateside, Messrs. J. Allan and Robert Adam; for Barrhead, Messrs. M. Shanks, David Thomson, and James Calderwood; for Hurlet, Messrs. James Yuille and Francis Oatt.

It was then agreed to, that Mr. George Longstaff should be appointed to deliver a course of lectures, and a person was appointed to wait upon him, and make the necessary arrangements. Mr. Longstaff having engaged to deliver the lectures, a meeting of the Committee was called on the 19th August, and the following is a copy of the minute drawn out at the time.

"At a Meeting of the Committee appointed to conduct the affairs of the Mechanics' Institution for the Parish of Neilston, it was found that the money collected, amounted to £40 10s.; and upon votes being taken, 'proceed,' or 'not proceed,' it was unanimously agreed to 'proceed' with the undertaking.

"Resolved unanimously, That the sum of seven shillings and sixpence be given to the Preses, to defray the expense of 200 tickets to be issued to the members of the Institution.

"Resolved, That the title of this Society be, 'The Levern Mechanics' Institution;' and the Committee hereby authorise Mr. Shanks, their preses, to contract with tradesmen to seat Mr. Cowan's hall for the purpose of accommodating the subscribers at the lectures.

"Resolved also to write Mr. Longstaff, offering him the sum of fifty pounds for a course of fifteen lectures."

Mr. Cowan's hall having been fitted up, and the whole arrangements completed with Mr. Longstaff, he delivered his first or introductory lecture on Tuesday, the 23d August. At this time the subscribers had increased to 162; and besides these, several attended the first lecture, paying 1s. for admission. Mr. Longstaff's lecture gave very general satisfaction; and every one left the hall highly satisfied with the curious and instructive experiments which the lecturer had exhibited.

Since Mr. Cowan's hall has been fitted up, it has been found much too small for the purpose, there having been a greater demand for tickets at the following lecture than there were either seats for, or even room to stand. In consequence of this, application has been made for the use of the Barrhead meeting-house, which has been obtained;-

and in future the lectures will be delivered in it. It has been proposed that apprentices shall be admitted to the lectures at half-price, which we hope will be agreed to. We trust that in this Institution a library will not be overlooked, as it may be considered as quite indispensable in a Mechanics' Institution. If such a thing shall be adopted, we would recommend, in order to suit the convenience of the different districts, the plan of Itinerating Libraries adopted in Haddingtonshire, an account of which will be found in our last Volume, No. LXXII.

GENERAL BIOGRAPHICAL DICTIONARY.*

Among the many works at present publishing in numbers and parts, we have seen none which we can consider so valuable as this Biographical Dictionary, published by Messrs. Hunt & Clarke. Biography is a useful as well as a delightful study, and it gives us great pleasure to observe a work of this nature given to the world on the cheap plan. This Dictionary seems, so far as it has yet gone, to be compiled with much care, industry, and judgment. The lives are concise and neatly written, and seem to form an excellent medium between the length of those in some works of the same nature, and the conciseness of others. The reference to the authors from whence the facts are taken is useful, in so far as it allows those who may wish to inquire farther to go to the source. The cheapness of the work brings it within the reach of the poorest individual, and the beauty of the printing and paper and the manner in which it is got up, makes it fit for the library of any gentleman. We extract from it the life of D'Alembert, the French Mathematician.

Alembert, (John Le Rond d') an eminent French philosopher, born at Paris, Nov. 17, 1717. He was the illegitimate son of Destouches Canon and Madame Tencin, the last of whom unfeelingly caused him to be exposed as a foundling near the church from which he was named John Le Rond. Informed of this discreditable fact, his father listened to the voice of nature, took measures for his instruction, and insured for him a suitable independency for life. He received his early education from the Jansenists, in the college of four nations, where he showed early marks of genius and capacity; and as he composed, in the first year of his philosophical studies, a commentary on the epistle of St. Paul to the Romans, his teachers flattered themselves with the hopes of maturing another Pascal. With this view the attention of the pupil was directed both towards the mathematics and theology; but his attachment to the former soon absorbed all his faculties, to the complete disappointment of the Jansenist party. The temperament of D'Alembert was strictly philosophical, in every sense of the term; for, on his quitting college, desiring nothing more than a quiet retreat, where he might pursue his studies with tranquility, he took up his residence in the family of a glazier's wife, his nurse. Here he lived with great simplicity of manners for thirty years, and shared his rising advantages with those whose kind attentions had supplied the place of parental affection. With the quiet humour that so often attends great calmness of temper, he concealed from these good people his growing reputation, and amused himself with the compassion his sedentary occupation excited in his hostess, who told him one day, with infinite pity, that he would never be anything but a philosopher, whom she went on to describe as a fool who toils during his life, that people may talk of him after he is dead. In order to enlarge his income, D'Alembert at first turned his thoughts towards the law, and took his degrees. He soon found this profession unsuitable, and next applied to medicine; but his fondness for the mathematics absorbed every other consideration, and he finally abandoned himself entirely to that pursuit, the first fruit of which appeared, at the early age of twenty-four, in a masterly correction of the errors in Reyneau's "Analyse Demontrée." In 1741 he was elected a member of the Academy of Sciences, and two years afterwards published his celebrated "Treatise on Dynamics," in which he established the principle of an equality each instant between the changes which the motion of a body has undergone, and the forces which have been employed to produce them. The discovery of this principle was followed by that of a new calculus of partial differences, the first application of which appeared in a "Discourse on the General Theory of the Winds," a treatise that obtained him the prize medal in the academy of Berlin. In the year 1749 he furnished a method of applying his new principle to any given figure, and solved the problem of the precession of the equinoxes. In 1752 appeared his treatise on the resistance of fluids; and about the same time he published, in the Memoirs of the Academy of Berlin, his "Researches concerning the Integral Calculus," which is greatly indebted to him for its subsequent rapid progress. Other pieces, published at various times, by the two academies of Paris and Berlin, were afterwards collected under the title of "Opuscules Mathematiques." D'Alembert also wrote "Recherches sur differens points importans du System du Monde;" which numerous and original productions rank him among the most celebrated mathematicians of the age. In addition to these particular claims, he is also understood to be the projector of that vast undertaking, the able precurser of many more of the same kind, the "Encyclopedie," which great work was begun, in 1750, by himself, Voltaire, Diderot, and others. To D'Alembert the world is indebted for the excellent preliminary discourse, so distinguished at once for just thinking and fine writing. Uniting with the character of an eminent mathematician that of a refined and polished scholar, he displayed his talents in many other literary productions, a list of which will conclude this article: one of these, "On the Destruction of the Jesuits," is peculiarly caustic. His "Elements of Philosophy" also produced no small controversy; and the enmity excited by this work, and the article "Geneva" in the Encyclopedia, was so great, that the king of Prussia, whose flattering notice he had previously secured by a dedication to him of his "Theory of the Winds," offered him a retreat at Berlin. This offer he however declined, as he had previously done an invitation from Catherine of Russia to superintend the education of her son, the grand duke, with a pension of a hundred thousand livres. In 1772 D'Alembert was elected secretary to the French Academy, and continued its history by Pellisson and Olivet, by writing, in the form of panegyrics, or *eloges*, a history of the members deceased from 1700 to 1771. His influence in the Academy of Sciences, and still more in the French Academy, concurred to give him great importance during the latter part of his life; and although called by his enemies the *Mazarin* of literature, in consequence of this influence, it was undeniably acquired by real weight of character, as no one courted patronage or countenance throughout life with more disinterestedness. Gratitude, indeed, induced him to dedicate two of his works to the Messrs. d'Argenson, to one of whom he owed the pension of 1200 livres granted him by Louis XV in 1756; but he made no sacrifice of probity or consistency in so doing, while to worthy men in adversity and under persecution he was a firm and constant friend. His sensibility towards those who had guarded his almost unprotected infancy, has already been recorded; and when his growing fame induced Madame Tencin to inform him of the secret of his birth, he feelingly exclaimed, "Ah, Madame, what do you tell me? You are but a step-mother; the glazier's wife was my real parent." The death of this distinguished man took place October 29, 1783, in the sixty-sixth year of his age, and in the very zenith of his reputation. D'Alembert exhibited the rare mental combination of mathematical genius with an elegant taste for polite literature and great powers of general application. It is not to be denied, that his aversion to superstition and priestcraft led him into the regions of scepticism; and that in consequence of his labours in the Encyclopedia, and his writings against the Jesuits, he is considered one of the most earnest of the band of philosophers who laboured so potently against priestly influence and monkish domination in France. It is unnecessary to advert to the imputations which, in common with Voltaire and others, he has thereby incurred, of producing the Revolution. The justness of these unqualified censures, as party spirit subsides, begins, however, to be doubted: and while it is impossible to deny the corruption, misgovernment, and oppression which reigned in France previous to that great convulsion, it is absurd to attribute to philosophical and literary influence a reaction which our Chesterfield clearly foresaw, before such influence had materially operated, and which even Louis XV so far anticipated as to express himself consoled by his conviction, that the disordered national system which he administered would at worst last *his own time.* The profligacy of the court and noblesse, the gross irregularity and baneful influence of the clergy, the disgusting mixture of levity and fanaticism in the provinces, illustrated every now and then by legal murders like those of Calas and De Barre;—these, with a degree of misgovernment, oppressive even to wretchedness, and productive of financial disorder which had become utterly unmanageable, may sufficiently account for the French Revolution, without recourse to the complexion of a literary association which was as much an effect of national disorder as the great event so disproportionately connected with it. Corruption and misrule are too much favoured by theories which pertinaciously ascribe the evils produced by them to contingencies and second causes. What is usually called the French philosophy coloured but did not create the revolutionary crisis, which clearly originated in a long course of bad government: an observation that pretends not to settle its speculative claims or demerits in other respects. The following is a list of the principal works of D'Alembert, to which is to be added a great number of interesting papers in the Memoirs of the Academies of Paris and Berlin, and his important share in the Encyclopedia: 1. "Traité de Dynamique," Paris, 1743, 1750, 4to; 2. "Traité de l'Equilibre et du Mouvement des Fluides," Paris, 1744, 1770; 3. "Réflexions sur la cause génerale des Vents," Paris, 1747, 4to; 4. "Recherches sur la Precession des Equinoxes, et sur la Mutation de l'Axe de la Terre dans le Systemes Newtonien," Paris, 1749, 4to; 5. "Essais d'un nouvelle Théorie du Movement des Fluides," Paris, 1752, 4to; 6. "Recherches sur differens points importans du Systéme du Monde," Paris, 1745-56, 3 vols. 4to.; 7. "Elemens de Philosophie," Paris, 1759; 8. "Opuscules Mathematiques, ou Memoires sur differens Sujets de Geometrie, de Mechaniques, d'Optiques, d'Astronomie," Paris, 9 vols. 1761 to 1773; 9. "Elemens de Musique, theoriques et practique, suivants les Principes de M. Rameau," Lyons, 8vo; 10. "De la Destruction des Jesuites," 1765.—*Biog. Univ. Hutton's Math. Dict.*

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* A General Biographical Dictionary; containing a Summary Account of the Lives of Eminent Persons of all Nations, previous to the present Generation. London; Hunt & Clarke. Glasgow; W. R. M'Phun. 1825.

ON FORGE SCALES. By M. P. Berthier.

[Continued from p. 45.]

It remains to be ascertained if the forge scales can be a mixture of protoxide and deutoxide. If that were so, since the protoxide is very greedy of oxygen, they should have a great tendency to combine with that body; whereas, not only are they wholly unalterable by exposure to the air, but are acted on even by concentrated and boiling acid only very slowly and with great difficulty. I endeavoured to determine their composition by this method, estimating the quantity of oxygen absorbed by the increase of weight; but I was unable to convert them entirely into peroxide. It is, moreover, very doubtful if the protoxide of iron can exist in a free state; for, being a base which has such attraction for oxygen that it decomposes water, it is very difficult to obtain it absolutely uncombined. The dry way appearing to be the only means by which we can hope to succeed, I made several trials after that manner, but without success. The following process seemed the most likely to accomplish the object in a direct manner.

I took several black lead crucibles lined with charcoal, and placed 100 grammes (1544 grains) of pulverized and finely sifted forge scales in each; I then filled the crucibles with charcoal, and closed their mouths with covers, carefully luted on, and exposed them in a wind furnace, to a heat of about 70° of the pyrometric scale. I took them out of the fire in succession—the first in half an hour, and the last in three hours, and compared the results. All the buttons had become solid, without changing their form or diminishing in volume; they were covered with a coating of metallic iron, and the oxide in the centre was neither fused nor altered; it gave the same relative proportion of peroxide and protoxide by analysis, viâ humidâ, as at first. The thickness of the metallic coat was proportionate to the time the crucible had remained in the fire; the maximum thickness was five millimetres, (nearly .2 of an inch.) It has a peculiar aspect; its surface is dull, and fracture granular; its colour is grey, inclining to olive; it takes a brilliant polish by being rubbed against hard substances; it may be cut with a knife, and reduced in that manner to a very fine powder; it is as soft as lead, and has no elasticity; it flattens by a blow, and retains the mark of the hammer; its specific gravity, at the utmost, does not exceed one-third of that of forged iron; it is, in fact, pure iron, minutely divided, and in a state analogous to that of spongy platina.

If the cementation has been continued for a considerable time, the section of the button presents, from the surface to the centre, first, a very thin layer of metallic iron of a deep blue or black colour; secondly, a thick layer of iron, of an uniform colour, inclining to olive; thirdly, a layer with shades of black and olive, which soon passes to the pure, and slightly metallic black, of the scales. I examined the olive-coloured part, with the idea that it might probably contain a mixture of metallic iron and protoxide, but I found it composed wholly of reduced iron of the utmost purity, and there is every reason to think that it is even perfectly free from carbon. When treated with muriatic or sulphuric acid, it dissolves without leaving any residuum, and hydrogen gas is disengaged to the last. The last portions dissolved have the same aspect as the whole mass. When fused in a black lead crucible, either alone or with the addition of an earthy glass, instead of losing weight, as would happen if it contained protoxide, it increases from 0.01 to 0.02. The portion with shades of black and olive behaves like a mixture of metallic iron and forge scales; in the moist way, red oxide is always found in it. This fact proves that metallic iron exerts no action on the oxide of the scales, and, consequently, that it is impossible to obtain the protoxide by heating any oxide with iron. The bluish coat of the buttons seemed to me to be steely iron, or to have passed to the state of steel, by the absorption of a certain quantity of carbon; but I have not positively ascertained the fact.

The cementation of the peroxide of iron presents as interesting and more varied results, as the cementation of the forge scales. If the mass be not very large, as long as any red oxide remains in the centre, no metallic iron is produced at the surface, but only black oxide.—When the heat has been kept up a sufficient time, we find in the centre only magnetic oxide, and we may observe towards the surface, as in the cementation of the forge scales, the bluish steel layer, the layer of olive-coloured iron, and the layer shaded with olive and black. The magnetic oxide in the centre is variable in its composition; in one experiment I found in it 0.48 of peroxide, and 0.52 of protoxide;

and in another 0.60 of peroxide, and 0.40 of protoxide. Since the native magnetic oxide contains 0.69 of peroxide, and 0.31 of protoxide, it is obvious that the oxide in question must be a mixture, in variable proportions, of the magnetic oxide of the forge scales, and native magnetic oxide.

It appears, from what we have seen above, that the peroxide of iron is changed by cementation, first, into an oxide similar to the native magnetic oxide, and that as soon as this change has been effected, its reduction begins from the surface to the centre, the process going on in such a manner that, in proportion as metallic iron is produced at the surface, the deutoxide of the forge scales is formed in the interior of the mass, to its centre; but these proportions diminish from the surface to this point. Lastly, when the cementation is very far advanced, the button becomes covered with a layer of steely iron of appreciable thickness.

How does it happen in these experiments, that the oxide of iron is reduced without being in contact with carbon, and even when several centimetres (1 centimetre = 0.39 inch) distant from it? This is a question which, in the present state of our knowledge, imperiously demands an answer, and deserves to be considered. We might suppose that the effect is produced by the inflammable vapours from the furnace, which penetrate all porous substances; but it is easy to satisfy oneself that this is not the efficient cause, at least of the reduction of oxides of iron into metallic iron. In fact, if we fill a crucible with red oxide of iron, placing a layer of charcoal below it at the bottom of the crucible, or if we place the oxide at bottom and cover it with charcoal; or lastly, if we introduce charcoal into the centre of a mass of oxide of iron, and heat it for an hour or two, we shall find that metallic iron is formed only in that part of the mass which was next the charcoal, and that there is not the slightest trace of it at the surface of the button in the other parts, although those parts were exposed, like all the rest, to the inflammable gases of the furnace.

The formation of the forge scales on the surface of iron, is quite as inexplicable as the reduction of the oxides by cementation. The oxidation of hot iron by the air is a gradual process, for the crust of the scales is much thicker on large masses, which require a long time to be heated, than on thin bars or plates, which heat much more quickly: now, as soon as a certain quantity of oxide is formed, it covers the iron like a varnish, and prevents its contact with the air; it must therefore attract its oxygen through the oxides, just as the oxides attract the carbon through the metallic iron.

These effects must have certain limits, which it would be important to ascertain, as they may perhaps furnish an explanation of the phenomena.

USEFUL RECEIPTS.

Composition of an unchangeable Cement.—The following cement has been used with great success in covering terraces, lining basins, soldering stones, &c. and it every where resists the filtration of water; it is so hard that it scratches iron. It is formed of 93 parts of well burnt brick or clay, and seven parts of litharge and of linseed oil. Nothing can be more simple than its composition, or the manner of using it. The brick and litharge are pulverised, the latter must always be reduced to a very fine powder; they are mixed together, and enough of linseed oil added to the mixture, to give it the consistence of thin plaster. It is then applied in the manner of plaster, the body that is to be covered being always previously wetted with a sponge. This precaution is indispensable, otherwise the oil would filter through the body, and prevent the mastic from acquiring the desirable degree of hardness. When it is extended over a large surface, it sometimes happens to have flaws in it, which must be filled up with a fresh quantity of the cement. In three or four days it becomes firm.

Method of preserving Apples and Pears.—The best time for gathering fruit is when it begins to drop off spontaneously. This is from the middle of September to the end of October. Ladders which will reach to the top of the trees must be provided; likewise baskets for the reception of the fruit. In plucking fruit, the best rule is to take what appears ripest in your hand, and raise it level with the foot-stalk; if it parts from the tree, lay it carefully into the basket, otherwise let it hang. The trees should therefore be examined every three or four days.

In the fruitery, the fruit is to be laid in heaps, and covered with clean cloths and mats above, or with good natural hay, in order to its sweating. This is generally effected in three or four days; and the fruit may be allowed to lie in the sweat for three or four days more. They are then to be wiped, one by one, with clean cloths.

Some glazed earthern jars must then be provided, with tops or covers; and also a quantity of pure pit-sand, free of any mixture; this is to be thoroughly dried on a flue. Then put a layer of sand, an inch thick, on the bottom of the jar; above this a layer of fruit, a quarter of an inch free of each other. Cover the whole with sand, to the depth of an inch; then lay a second stratum of fruit, covering again with an inch of sand, and proceed in this way till the whole be finished. An inch and a half of sand may be placed over the uppermost row of fruit. The jar is now to be closed, and placed in a dry airy situation, as cool as possible, but entirely free from frost.

The usual time at which each kind of fruit ought to be fit for the table being known, the jars containing such fruit are to be examined, turning out the sand and fruit cautiously into a sieve. The ripe fruit may be laid in the shelves of the fruit-room for use, and the unripe is carefully to be replaced in the jars as before, but with fresh dried sand.

Some kind of apples managed in this way will keep till July. Pears will keep till April.

Method of Staining Wood Black.—Boil some chips of logwood in water for a quarter of an hour; then wash the piece of wood with it three or four times, allowing it to dry after each washing. Lastly, wash or paint the piece of wood by means of a common painting brush, with vinegar, prepared after the following manner:—Put one ounce of steel or iron filings into two ounces of vinegar; keep the phial near the fire, so as to be gently hot for about two hours; then decant the vinegar, and keep it for use.

To clean old Pictures.—Clean your picture well with a sponge dipt in warm beer, let it become very dry, and wash it with the finest gum dragon, steeped or dissolved in clear water. Never use blue starch, which tarnishes and eats out the colouring; or white of eggs, which casts a thick varnish over pictures, and only mends bad ones by concealing the faults of the colouring.

NOTICES TO CORRESPONDENTS.

C. D. will be inserted next week. John Miller requests us to desire all who may read Mr. Campbell's last statement, to read his letter in Number LXXXIV. We can really say nothing as to the engine mentioned by A. B., Lockerby, without knowing something more about it: we shall be very glad he sends us a drawing and description of it. Scoticus will perceive that we are always alive to what we think will interest our readers; we thank him, however, for his hint. There are several other Correspondents we have not time to notice.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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Communications (post paid) must be addressed.

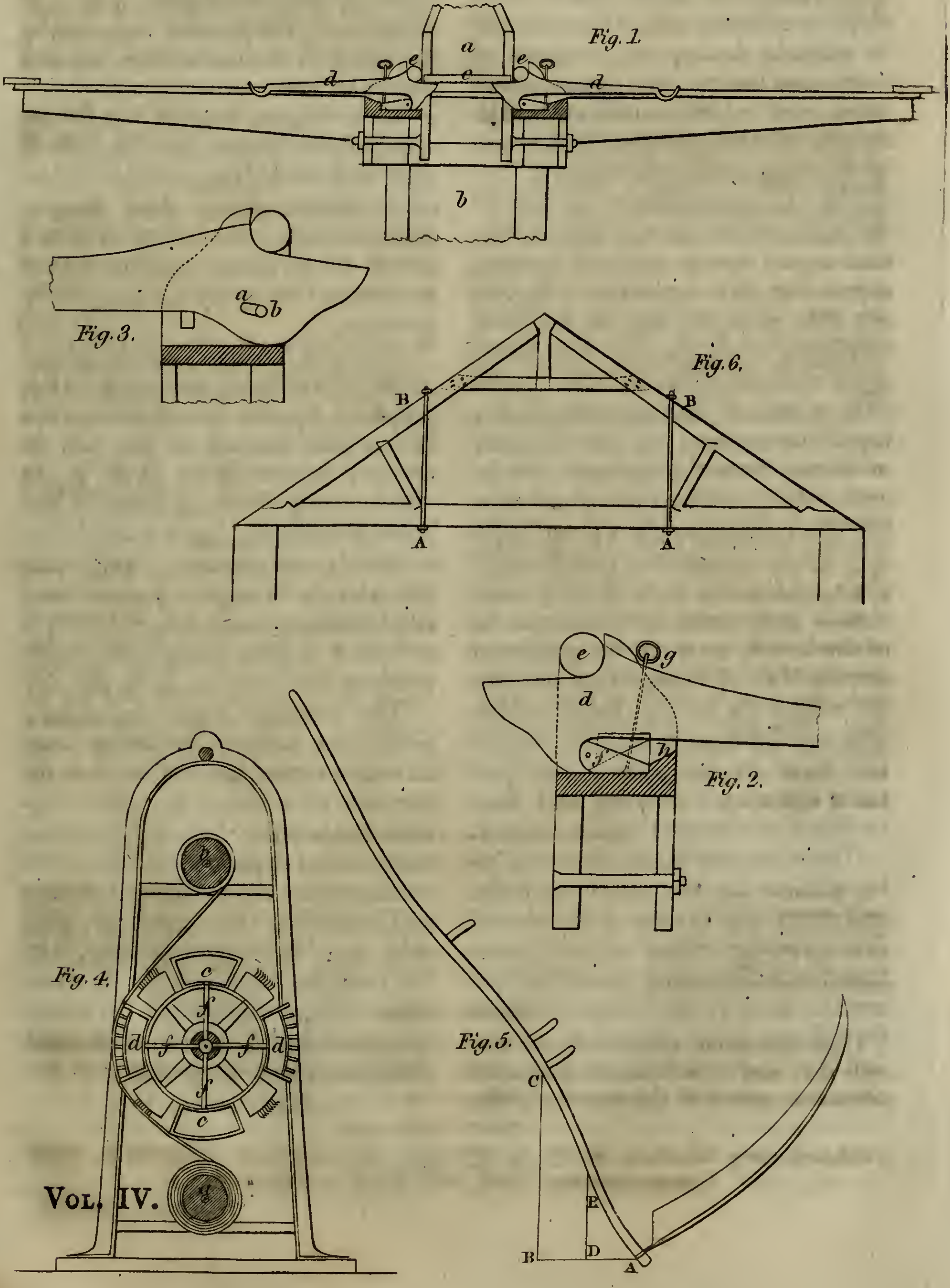
CURLL, PRINTER.

THE GLASGOW
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

> " No bounds have been fixed to the improvement of the human species; the perfectability of man is absolutely indefinite; the progress of this perfectability, henceforth above the control of every power that would impede it, has no other limit than the duration of the globe upon which nature has placed us."

No. XCI. *Saturday*, 17*th September*, 1825. Price 3*d*.

ROTCH'S IMPROVED FID FOR MASTS OF SHIPS; DANIELL'S MODE OF DRESSING WOOLLEN CLOTH, &c.



IMPROVED FID FOR MASTS OF SHIPS.

To BENJAMIN ROTCH, *Esq. of Furnival's Inn, in the City of London, for his Invention of an Improved Fid, for the Upper Masts of Ships and other Vessels.*

[Sealed, 21st August, 1823.]

THIS improvement is a mode of supporting the upper mast of a ship, by means of two levers adapted to suitable frames or carriages of iron, attached to the upper cross-trees, and which contrivance also admits of the mast being lowered without slackening the rigging.

Fig. 1, represents a section of the upper cross-trees, with the iron frames and levers attached thereto, supporting the top-mast. Fig. 2, is a side view of one of the iron carriages, with part of the lever, upon a larger scale; *a*, is the lower part or heel of the top-mast; *b*, the top of lower mast; *c*, the fid-plate, of three times the ordinary thickness; *d, d*, are the two levers turning upon gudgeons, *e, e;* and here it may be observed, that the fid-plate which supports the top-mast should rest upon the shorter arms of the levers, as near the gudgeons as possible; *f*, is a pall attached to the underside of the lever, which acts as a block or wedge to confine the lever in its place; this pall turns upon a pin or axle, and may be lifted by drawing up the ring, *g*.

The top-mast is to be raised to its station by the usual methods, and then the levers, *d, d*, turned (by pressing upon their longer arms) into horizontal positions, (as seen in fig. 1;) the palls are then let fall into their places, as shown, and by their ends bearing against the back parts of the carriage, the levers are confined in their positions, and the mast supported firmly, or, in nautical language, the mast is *fidded.*

When the fid is to be removed for the purpose of lowering the mast, the longer arms of the levers are to be pressed upon, and the palls or wedges being by that means relieved, may be drawn up by the rings, *g*. The smaller ends of the wedges now sliding up the inclined planes into the recesses, at the back of the carriages, permit the longer arms of the levers to rise, which they will do by the weight of the mast bearing upon their shorter arms, and when they are thus forced out of the fid holes, the mast may be lowered away by the top tackle pennant.

A slight variation in the above mode of confining the lever fid, is proposed by the introduction of a bolt or pin, instead of the pall or wedge; this is shown at fig. 3: in which nearly the same form of the lever is adopted; but a curved hole or slot is made as at *a;* and when this slot is brought opposite to a round hole in the carriage, the pin or bolt, *b*, may be introduced, which confines the lever fid in its place.

The patentee states in conclusion, that a lever or levers may have been used heretofore, for the purpose of assisting to raise a top-mast to its place, but such levers as those above described fitted to iron carriages, for the purpose of fidding and unfidding the upper mast of a ship, and with palls or bolts, &c., for retaining the mast in its situation, are, to the best of his knowledge and belief, entirely new, and, therefore, claimed by him.

[Inrolled, February, 1824.]

* * *

IMPROVED MODE OF DRESSING WOOLLEN CLOTH.

To Joseph Clisild Daniell, *of Stoke, in the County of Wilts, Clothier, for his Invention of certain Improvements in dressing Woollen Cloth.*

[Sealed, 20th November, 1824.]

This invention is the application of combs or cards to the surface of woollen cloths, in the operation of dressing or finishing them, for the purpose of laying the pile or nap in a uniform manner in one direction only, and also of retaining the position of the nap, and glazing the cloth when its pile has been so laid, by the employment of heated boxes, passed against the distended surface of the cloth, to effect the same object as is usually performed by smoothing irons.

Machinery calculated to produce this object, may be variously constructed and modified, the patentee does not, therefore, confine himself to any particular arrangement, but exhibits such a contrivance as he has himself used, and found to be conveniently suited to the purpose. Fig. 4, is a section taken across the end of the machine, observing that the length of the machine will depend upon the breadth of the cloth to be dressed. The piece of cloth about to be operated upon, is rolled upon the cylindrical roller, *a*, having been previously wetted or damped with cold water, but not left in a dripping state. From the lower roller, *a*, it is conducted over the periphery of the dressing cylinder, or drum, in the middle of the machine, to the upper roller, *b*, to which it is attached, and these rollers being made to revolve, by means of riggers or gear connected to their axles, in any of the usual ways, the cloth is drawn from the lower roller on to the upper roller, much in the same way as in ordinary gig mills, while the dressing cylinder moves with great velocity in a contrary direction, rubbing against the surface of the cloth.

The construction of the dressing cylinder in the middle of the machine is peculiar: it consists of several hoops or a hollow wooden barrel, on the outer periphery of which is placed four, or any other convenient number of hollow brass or copper boxes, *c, c,* and *d, d,* these boxes are to be heated by steam, and for this purpose, the axle, *e,* of the drum is made hollow, and is connected, by a properly constructed stuffing-box, to a steam pipe leading from a boiler. Hollow arms, *f, f, f, f,* extend from the axle to the boxes, *c, c,* and *d, d,* and by means of these the steam is conducted from the axle into the boxes. At the lower or outer edge of each box on its side, there is a small hole for the purpose of allowing the steam to blow through, to prevent its condensing within, or to permit the water, if any condensation should take place, to be blown out. The outer periphery or surface of the boxes, *c, c,* and *d, d,* are not alike; the surfaces of the boxes, *c, c,* are made perfectly smooth, in order to run against the cloth and lay its nap evenly, but the outer periphery of the boxes, *d, d,* are made with indented or waved ribs, that is, ribs extending straight along the boxes, but scolloped or indented on their edges. These indentations are so placed, that the protuberant part of one shall come opposite to the hollow of the other, and by the employment of these uneven surfaces, it is considered that the nap of the cloth will be more effectually laid down. Between these heated boxes, blocks are placed with cards or wire brushes on their periphery, the points of which reach up to about the same elevation as the boxes. These cards are intended to comb the wool or pile upon the cloth previous to its being laid smooth and glazed by the heated boxes.

The barrel so constructed, and mounted in the frame, is made to revolve with considerable velocity by means of a rigger or gear in an opposite direction to that in which the cloth is proceeding; and thus, as the cloth winds from off the bottom roller on to the top roller, the rapid revolution of the drum causes the cards or wire brushes to comb down the pile or nap; and immediately following, the heated boxes to lay smooth and glaze the surface of the cloth, which will give it an extraordinary brilliancy in appearance, and a peculiar softness to the touch; thereby obtaining a preference over cloths of similar quality, dressed by the ordinary means.

[Inrolled, March, 1825.]

ON CUTTING CORN WITH A SCYTHE.

Gentlemen,—In the Stirling Courier a gentleman is mentioned who made the following experiment on cutting corn with a scythe, which answered the purpose extremely well, and exceeded his utmost expectations; and, as many of your readers may not have seen or heard of this method, I think it not unworthy a place in your valuable Magazine.

Fig. *5*, is an outline of the scythe after the necessary articles are attached to it, and which any man may make himself at little or no expense. The following brief explanation of the sketch will at once prove its simplicity. A is a piece of wood about two feet long, and half an inch thick, fastened perpendicularly to the end of the shaft, so as to form nearly a right angle with the upper end of the scythe. From B, another piece of wood is attached, about three feet long, fastened a little below the handles at C, and parallel to this piece of wood, another shorter one is fastened at D, and ends at E. When this simple addition to the scythe was made, it carried the corn cleanly away, and laid it in the swath perfectly regular; at the same time, it cuts the corn much smoother, and makes the stubble much shorter than can possibly be done by an ordinary sickle.

C. D.

Woodside-Road, 5th Sept. 1825.

METHOD OF ROOFING LARGE SPANS.

Gentlemen,—Not perceiving in your Magazine any observations on roofing, I purpose sending you occasionally a few hints as they suggest themselves.

There appears in several of the lately erected chapels in the city, a desire for economy, by sinking cellars for the storage of goods. Now, I see no reason why the roofs should not also be made use of for various purposes, such as lecture-rooms, school-rooms, &c. The plan, which I now send you, (see fig. 5,) is as strong as the usual mode of king and queen posts, and will require rather less timber. I have avoided giving any of the sizes, as that must depend upon the span of the building.

The only place where I know this mode of roofing to have been adopted, is at St. James's chapel here. It was designed by William Reid, Architect, and I understand answers the purpose it was designed for exceedingly well.

I am, yours, &c.

Glasgow, 8th Sept. 1825. A.

Description.

A, A, iron rods which hing the tie beams to the truss, and is screwed up from the bottom and at top. It will be necessary to have iron sockets screwed to the rafters with nuts and washers below.

B, B, position of the sky-light windows.

PRESENT POPULATION OF IRELAND, AS CONTRASTED WITH THAT OF OTHER COUNTRIES.

The returns for Ireland in 1821 are,

Males,	3,341,926
Females,	3,459,901
Total,	6,801,827

This, taking the surface of Ireland at 18,700 Irish square miles, gives 363 persons to an Irish square mile. The density of this population is evinced by the following comparison:

	To an English square mile.
Ireland,	223
England,	207
Scotland,	70
Wales,	98
France,	144
Confederated States of Germany,	111

Thus Ireland is three times as populous as Scotland, one and a half as populous as France, and twice as populous as Germany. But the density of the population of Ireland does not so much exceed that of England as has been supposed. In Ireland, the people are more dispersed. In England more crowded into large towns and cities. The density of the Irish population is greatest in the counties of Armagh and Monaghan. In the former, there are 480 in an English square mile, in the latter somewhat less. This is, however, exceeded by the population of Lancashire, which, including the great towns of Liverpool and Manchester, amounts to 600 to every square mile, and excluding these to about 490. In examining the returns of the population of a country, it has been considered that an estimate may be formed of the rate at which the population is actually increasing, by the proportion of the number under 15 years of age, to the whole population. In a country where the numbers are nearly stationary, about one-fourth are below that age. In the United States of America, nearly one-half are below 15, and in Ireland about two-fifths. The different provinces of Ireland exhibit, in this respect, a different proportion.

Of a million of persons, there are under 15 years of age,

In Munster,	457,925
In Connaught,	424,647
In Ulster,	404,080
In Leinster,	398,953
In United States of America,	488,908
In Sweden,	346,105
In parts of Switzerland,	250,000

Hence it appears, that Munster and Connaught have been most rapidly augmenting. Munster even approaches the rate of the United States. In Ireland, the proportion of males to females is, for every 100 males, nearly 104 females. In England there are, for every 100 males, about 106 females; while, in Scotland, for about 100 males, there are 113 females. In Dublin, the males are in proportion to the females, as 100 to 115.

NOTICE OF A METEORIC STONE WHICH FELL AT NANJEMOY, IN MARYLAND, NORTH AMERICA, ON THE 10th FEBRUARY, 1825. By Dr. SAMUEL D. CARVER, in a Letter to Professor SILLIMAN.

[From the American Journal of Science for June, 1825.]

I TAKE the liberty of forwarding you a notice of a meteoric stone which fell in this town on the morning of Thursday, Feb. 10, 1825. The sky was rather hazy, and the wind south west. At about noon the people of the town and adjacent country were alarmed by an explosion of some body in the air, which was succeeded by a loud whizzing noise, like that of air rustling through a small aperture, passing rapidly in the course from north west to south east, nearly parallel with the river Potomac.

Shortly after, a spot of ground on the plantation of Captain W. D. Harrison, surveyor, of this port, was found to have been recently broken, and on examination a rough stone of an oblong shape, weighing sixteen pounds and seven ounces was found about eighteen inches under the surface. The stone when taken from the ground, about half an hour after it is supposed to have fallen, was sensibly warm, and had a strong sulphurous smell. It has a hard vitrious surface, and when broken, appears composed of an earthy or siliceous matrix, of a light slate colour, containing numerous globules of various sizes, very hard, and of a brown colour, together with a small portion of brownish yellow pyrites, which become dark coloured on being reduced to powder. I have procured for you a fragment of the stone, weighing four pounds and ten ounces, which was all I could obtain.* Various notions were entertained by the people in the neighbourhood on finding the stone. Some supposed it propelled from a quarry eight or ten miles distant on the opposite side of the river; while others thought it thrown by a mortar from a packet lying at anchor in the river, and even proposed manning boats to take vengeance on the captain and crew of the vessel.

I have conversed with many persons living over an extent of perhaps fifty miles square; some heard the explosion, while others heard only the subsequent whizzing noise in the air. All agree in stating that the noise appeared directly over their heads. One gentleman, living about 25 miles from the place where the stone fell, says, that it caused his plantation to shake, which many supposed to be the effect of an earthquake. I cannot learn that fire-balls or any light was seen in the heavens—all are confident that there was but one report, and no peculiar smell in the air was noticed. I herewith transmit the statement of Captain Harrison, the gentleman on whose plantation the stone fell.

Statement of W. D. Harrison, Esq.

On the 10th of Feb. 1825, beween the hours of twelve and one o'clock, as nearly as recollected, I heard an explosion, as I supposed, of a cannon, but somewhat sharper. I immediately advanced with a quick step about twenty paces, when my attention was arrested by a buzzing noise, resembling that of a humming bee, which increased to a much louder sound, something like a spinning wheel, or a chimney on fire, and seemed directly over my head; and in a short time I heard something fall. The time which elapsed from my first hearing the explosion, to the falling, might have been fifteen seconds. I then went with some of my servants to find where it had fallen, but did not at first succeed, though, as I afterwards found, I had got as near as thirty yards to the spot; however, after a short interval, the place was found by my cook, who had (in the presence of a respectable white woman) dug down to it before I got there, and a stone was discovered from 22 to 24 inches under the surface, and which after being washed, weighed sixteen pounds, and which was no doubt the one which I had heard fall, as the mud was thrown in different directions from 13 to 16 steps. The day was perfectly clear, a little snow was then on the earth in some places, which had fallen the night previous. The stone when taken up had a strong sulphurous smell; and there were black streaks in the clay, which appeared marked by the descent of the stone. I have conversed with gentlemen in different directions, some of them from 18 to 20 miles distant, who heard the noise (not the explosion.) They inform me that it appeared directly over their heads. There was no fire-ball seen by me, or others that I have heard. There was but one report, and but one stone fell to my knowledge, and there was no peculiar smell in the air. It fell on my plantation, within 250 yards of my house, and within 100 of the habitations of the negroes.

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* This specimen has not yet arrived.—*Amer. Ed.*

I have given the statement to Dr. Carver at his request, and which is as full as I could give at this distant day, from having thought but little of it since. Given this 28th day of April, 1825.

W. D. Harrison.
Surveyor of the Port of Nanjemoy,
Maryland.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION IV.

Soap.

Very considerable quantities of this article are used in the several stages of bleaching, chiefly for washing the goods, and, at the conclusion of the other processes, for finishing them, and giving them that gloss and silky softness in handling, which insures them a ready sale. Like most of the chemical manufactures, soap-making is commonly but little understood by those who are engaged in it, and, consequently, when brought to market, different parcels are very unequal in value. They are commonly ignorant of the proper characteristics of good tallow, which should be as free as possible from sebacic acid; and they are seldom acquainted with the proper method of oxidizing the soap while boiling; of allowing the alkali a full opportunity of forming a chemical combination with the oil or tallow; and of producing from potash a firm consistent soap. Rumford's improvement of boiling by steam, by which a percussion is given to the tallow and the ley, is still less known. (Phil. Mag. XXIX. 283.)

For this manufacture, it is necessary to use a fixed alkali, in a state of causticity. The soap-makers here, take a large quantity of Scotch or Irish kelp, or Spanish barilla, break it to pieces, grind it coarsely by a horse mill, and when they have mixed it with a sufficient quantity of quicklime to absorb the carbonic acid, they throw the whole into large wooden or iron vats, and cover it with water. At a proper time this liquid, now formed into alkaline ley, is let off into iron receivers below, and the vats are again filled with water, and when impregnated with alkali, this also is let off into the receivers. When a proper proportion of this ley has been prepared, a quantity of Russian or English tallow is put into a large iron boiler and melted with the ley. At first the tallow appears liquid like oil, but during its boiling it gradually thickens. When most of the alkali of the first portion of ley has united with the tallow, the weak liquor is pumped from beneath, and fresh leys are added in their stead, which are boiled as before till the whole acquire a proper consistence, when it is cooled and prepared for sale. In making yellow soap, which, however, is seldom used in bleaching, one-third or one-fourth part of resin is added to the tallow, or to fish oil, which renders the article considerably cheaper. In making soft soap, again, which is much used in the bleachfield, potash and not soda is used, as the latter unites too firmly with oil to be fit for this purpose. Soft soap contains a great proportion of water.

The alkali renders the oil or tallow soluble in water, and thus the whole is made capable of uniting with, and removing such extraneous substances as are combined with, or adhere to the cloth. The tallow itself could never effect this, for though it might combine with such extraneous matters, it could not disengage them; the alkali, again, would of itself act too violently, and could not be handled with safety by those employed in washing, for it could not be used to any advantage as a detergent, except in a state of causticity. On the other hand, it is undoubtedly the tallow of the soap which gives goods that softness and smoothness which is so requisite to make them saleable: when they are taken from the leys or the sours, or even after crofting, they always have a hard feel, which makes them appear *hask*, as the Scotch bleachers express it, and much coarser than they really are. To accompany the soap, good soft water however is indispensable, and no finishing can be perfect without this can be had in abundance.

LECTURE ON ANIMAL HEAT.

By PROFESSOR ANDERSON.

[We have been favoured, by a valued Correspondent, with the following Lecture on Animal Heat, delivered by Professor Anderson, in the year 1713, in his Experimental or Mechanics' Class of Natural Philosophy in Glasgow College. "It is," our Correspondent says, "a fair specimen of the ingenious and simple manner in which the Professor conducted his lectures, none of which have ever yet been published. This was taken down in short hand at the time, and is as near as I can recollect, the very language of the Professor."]

OF ANIMAL HEAT.

The facts concerning animal heat are contained in the Institutes of Physics, Propositions LIX. LX. LXX. There are four Theories concerning the generation of it.

1*st Theory.*

From the mixture of the aliments put into the stomach of the living animal, in a similar manner to the heat generated by the mixtures which you saw me make.

Objection 1st.—That these aliments will not generate any degree of heat; or if they do, that it will be greatly deficient for the purpose of keeping up the heat of the body to 96° of Fahrenheit's thermometer.

Objection 2d.—That the heat is kept up when there is no aliment in the stomach.

2*d Theory.*

From the friction of the blood upon the cavities of the vessels through which it moves.

Objection 1st.—The friction of a fluid upon a solid does not produce heat, as by water upon metal pipes. The heating of a musket ball, in passing through the fluid air, not being a proof, because it may have got that heat by friction upon the barrel, or from the air in passing through it without the operation of friction.

Objection 2d.—The churning of blood, when not in a putrescent state, does not produce heat.

3*d Theory.*

From the action of the nerves upon the blood vessels.

Objection 1.—The nerves are soft, and it is not easy to see how their action can produce heat in the blood.

Objection 2d.—There are cases where the nerves seem to have been totally inactive, and yet the heat is kept up.

But the *fourth theory* seems to remove the greatest difficulty on this subject, and to be good. We owe it to the persevering abilities and great ingenuity of Dr. Priestley, and of Dr. Adair Crawford, who some years ago was a student in this place.

4*th Theory.*

By an operation in the animal frame, the action of breathing is constantly taking fire from the air which surrounds us, and distributing it through the animal frame in such quantities as to keep up the heat to 96°, whatever is the temperature of the surrounding medium.

The shortest view that can be given of this ingenious theory is the following; and it depends upon a great variety of experiments, some of which are similar to those you have seen.

It is shown by a variety of experiments, that the quantity of absolute fire contained in the air that is pure, is diminished by the change which it undergoes in the lungs; and that the quantity of fire in every kind of air fit for breathing, is nearly proportional to its power of supporting animal life.

It is well known, that the blood undergoes a remarkable change of colour when circulating in a living animal, for the vivid arterial blood, in its passage through the capillaries of the venous system, acquires a deep and livid hue, and again resumes its light and florid colour in the lungs. Dr. Priestley has proved that similar alterations are produced in the colour of the blood, by exposure to pure air, and to inflammable air. Since, therefore, the arterial blood undergoes the same change of colour in the capillaries that it suffers by exposure to inflammable air; since it has an attraction to that fluid; and since the separation of inflammable air from animal substances is promoted by heat, and by the tendency of the juices to putrefaction, it is a fair conclusion, that the change which the blood undergoes in the capillaries, arises from its impregnation with this principle. And as the absorption of inflammable air is the cause of the change which is produced in the colour of the blood during its circulation through the capillaries, we may conclude, that, when the blood again recovers its florid colour in the lungs, the inflammable principle is detached. In the process of respiration, therefore, the pure air which is received into the lungs, combines with a portion of the inflammable air contained in the venous blood.

From these and other experiments, which cannot be detailed in this place, it follows, that animal heat depends upon a process resembling an elective attraction. The pure air is received into the lungs, containing a great quantity of elementary fire; the blood is returned from the extremities impregnated with the inflammable principle; the attraction of pure air to the latter principle is greater than that of the blood. This principle will therefore leave the blood to combine with the air; by this combination the air deposits a portion of its elementary fire; and as the capacity of the blood is at the same moment increased, it will instantly absorb that portion of fire which had been detached from the air. The arterial blood, in its passage through the capillary vessels, is again impregnated with the inflammable principle, in consequence of which its capacity for heat is diminished, as appears from a variety of experiments. It will, therefore, in the course of the circulation, gradually give out the heat which it had received in the lungs, and diffuse it over the whole system. Thus it appears, that, in respiration, the blood is continually discharging the inflammable principle, and absorbing heat or fire; and that, in the course of the circulation, it is continually imbibing this principle and emitting heat.

After this account of animal heat, we may now take a view of the whole experiments you have seen, and consequently of the Theory of Fire, though that theory was applied when the experiments were made.

1st, Then, it appears, that fire is in every body that surrounds us, and that it is exceedingly subtle.

2d. That it excites in our bodies, by its presence, a variety of sensations, for which there are various names.

3d. That when it is modified in one way, it produces heat, and moves in every direction, whether of straight or curve lines.

4th. That when it is modified in a different way, it produces a new sensation by the eye, and is always propagated in straight lines.

5th. That it is subjected to the laws of attraction, like all the minute parts of matter.

6th. That it has an elective attraction or affinity, similar to that of other bodies.

7th. That it is likewise subject to the laws of corpuscular repulsion.

8th. That it expands all fluids, expands one set of solids and contracts another; in consequence of which, thermometers and pyrometers have been contrived for measuring its presence in the bodies to which they are applied.

9th. That some bodies evaporate, some boil, and some burn, according to stated laws.

10th. That fire is often in such a quiescent state, that it does not affect the thermometer till the body is decomposed, or its constitution is altered; and hence it is called latent, or sensible, which was illustrated by the capacity of a spunge for holding water, or giving it out, according to the nature of its texture or bulk.

11th. That there is a heat in large animal bodies, which is got in the action of breathing, and taking from it its sensible or latent fire.

12th. That the earth is the great magazine of fire, and is subject to various changes from its internal fires.

13th. That the sun's rays are the great cause of heat to the surface of the earth by reflection.

We may conclude this subject by taking notice of some facts, which may now be easily understood, and which, as the pleasantest way, shall be put in the form of question and answer.

1st Question.—What is the reason of what was long since observed by Aristotle, and which is known to our cooks, that the bottom of the kettle, if it has no lid, is warmer immediately before it boils, than after it boils?

Answer.—The heat of water is not increased by boiling, which was unknown to the old Philosopher. As soon as it boils, the water is lifted up, and the fire escapes more easily.

2d Quest.—How does a man grow hot and cold?

Ans.—By clothes, the warm air of a room, by exercise, and in cold regions by covering with snow, and by hutting. He grows cold by depriving his body of fire, and by doing the contrary of what has been now mentioned.

3d Quest.—Why does he complain more of cold when the air is moist, or when it is in motion?

Ans.—Because moist air robs the body of its heat and wind, by making a constant change of the air upon the surface of the body, cools it still faster when moisture and wind are combined.

4th Quest.—What is the reason that, in time of frost, a razor will not cut, or, at least, without creating great pain, unless it is warmed?

Ans.—Because, if viewed with a magnifying glass, it appears like the edge of a saw, and when warmed, its edge is rendered smoother.

5th Quest.—How can we blow, according to the common expression, cold and hot with the same breath?

Ans.—Because if the breath is blown slowly it conveys heat, or a sensation of heat; but if blown with more violence, it produces a cold sensation.

6th Quest.—Why is the breath visible in frosty weather, and not in warm weather?

Ans.—Because it is kept in solution in warm weather, but the vapour is instantly condensed in frosty weather.

7th Quest.—Why does fire burn better in winter than in summer?

Ans.—Because in winter the air is less expanded, and by that means more air enters the fire in the same volume.

8th Quest.—What is the best method of extinguishing fire?

Ans.—By shutting up every crevice and preventing the admission of fresh air: for example, an extinguisher on a candle, which preventing any change of air, the fire is smothered by the carbonic acid gas of its own formation.

9th Quest.—Why does some compositions burn under water?

Ans.—They do not burn better under water than in the air, but such compositions have the property of furnishing pure air for themselves in the act of combustion.

10th Quest.—Why does a poker when heated at one end burn the hand if immersed in cold water?

Ans.—Because it is easier for the heat to pass up the poker, than to enter the cold water.

11th Quest.—Why does alcohol extinguish a live coal?

Ans.—By excluding the air from it.

13th Quest.—Why is the hand less burned by a spirit than by hot iron?

Ans.—Because the iron is denser, and can impart more heat in a given time than the spirit.

13th Quest.—Why is the smiths' fire made warmer by being moistened?

Ans.—Because the water is decomposed in the fire, furnishing oxygen and hydrogen, and the coals cake better, and keep in the heat.

14th Quest.—When will the waters of rivers freeze, and how are we to account for the non-freezing of Loch-Ness?

Ans.—The waters of rivers will freeze when they are cooled below the freezing point; but the non-freezing of Loch-Ness is owing to its immense depth, which, like the unfathomable ocean, is never cooled to the freezing point.

15th Quest.—Why does the freezing of flesh and vegetables preserve them from putrefaction?

Ans.—Because by excluding the air and freezing up the fluids, no putrefaction can take place without heat and moisture.

16th Quest.—What is the best method of roasting flesh in severe frost?

Ans.—First throwing it into cold water until all the ice is extracted, before it is put to the fire, otherwise it will burn on one side before it thaws throughout.

17th Quest.—What is the best method of eating fruit that has been frozen?

Ans.—By immersing them in cold water, the ice will come out on the outside in the form of a shell or crust. The same applies to frozen potatoes.

18th Quest.—When a thaw comes, why are the outside walls of our houses covered with hoar-frost?

Ans.—Because if the change be sudden, the air will indicate thaw, but the walls being still below the freezing point, continues to freeze the moisture of the air in form of hoar-frost.

19th Quest.—When the body has been long exposed to cold, what is the fittest thing to be done?

Ans.—If the body be frozen, first rub the frozen part with snow, and then with coarse dry cloths till heat returns.

20th Quest.—What is the best preservative against cold to travellers, sentries, or watchmen, and to such persons as can have no motion like them?

Ans.—To those who can have no motion, such as persons on coaches, clothing of flannels or of furs, and to watchmen and sentries, to keep constantly in motion.

There are many things relating to heat and cold, which, in the course of your observations and reading, you will be able to explain, I hope, by the application of these principles.

Let us conclude the subject, by observing the simplicity of this law of nature, and its beneficial effects in every part of our globe.

ON HYDRACIDS AND THEIR COMBINATIONS WITH SALINE BASES.

By Dr. J. Berzellius.

By the term hydracid, we understand a combination of a simple or compound body with hydrogen, which, although destitute of oxygen, possesses all the essential characters of the oxygenous acid. Hydracids must be regarded, therefore, as constituted of hydrogen and a peculiar radical, which, as is the case with the oxygen acids, may be either simple or compound. In consequence of this dissimilarity, they naturally divide themselves into two classes, *viz.* acids with a simple, and acids with a compound radical.

To the first of these classes belong: 1, *sulphuretted hydrogen gas;* 2, *seleniuretted hydrogen gas;* 3, *telluretted hydrogen gas;* 4, *hydrochloric acid;* and 5, *hydriodic acid;* chlorine and iodine being regarded as simple substances. My principal arguments against the new theory of the constitution of muriatic acid were founded upon the little analogy which subsisted between it and its combinations, and the hydracids and their salts, in so far as the latter were known at the time of its first promulgation. The subsequent discovery, however, of many hydracids, and in particular of those with a compound radical, has developed the analogy between muriatic acid and the hydracids so completely, that these objections can no longer be considered as valid.

To the *latter* class, namely, hydracids with a compound radical, belong: 1, *prussic acid,* (cyanuretted hydrogen;) 2, *sulphoprussic acid* (sulphuretted cyanogen combined with hydrogen;) 3, *ferroprussic acid* (a combination of cyanuretted iron with cyanuretted hydrogen;) and to these may be added, 4, another compound not so accurately known, whose constituents, although differently proportioned, are also cyanogen and sulphur.

Sulphoprussic acid may be obtained by mixing a solution of sulphocyanuret of potassium in a minimum of water with concentrated phosphoric acid, and distilling in a retort with a gentle heat. The hydracid is volatilized, and condenses in the receiver. The potassium in this experiment, in order to combine with the phosphoric acid, oxidizes itself at the expense of water, and the hydrogen thus set at liberty unites at the same instant with the sulphuretted cyanogen.

Sulphoprussic acid is so constituted, that its elements, if reduced to the gaseous state, would all occupy the same volume: or it is composed, by weight, of hydrogen 1.68, azote 23.85, carbon 20.30, and sulphur 54.17. Its saturating capacity, as is the case with all hydracids, is such that it combines with a quantity of a base, whose oxygen is exactly sufficient to convert its hydrogen into water.

The radical of this acid, *sulphuretted cyanogen,* has not hitherto been isolated, and is known only in the compounds which it forms with hydrogen or with metals. When we attempt to obtain it by distilling a sulphuretted metallic cyanuret, it always undergoes decomposition: a metallic sulphuret containing a minimum of sulphur remains, and sulphuret of carbon, cyanogen, and azote, are disengaged.

But cyanogen combines also with a double proportion of sulphur, and forms a bisulphuret, which, in union with hydrogen, affords a hydracid, differing in composition from the foregoing, and capable, like it, of combining with metals. This new acid was discovered by Wôhler. He found that when sulphuretted cyanuret of mercury is gently ignited in a glass vessel filled with muriatic acid gas, or with sulphuretted hydrogen gas, there is deposited upon the colder sides of the vessel a quantity of anhydrous sulphuretted prussic acid, in the state of colourless transparent drops, which, after a few seconds, become solid, and form transparent stellular, aggregated groups of crystals. These crystals rapidly undergo decomposition, cyanogen is disengaged, and a pomegranate yellow, opaque, uncrystalline powder remains. This powder is insoluble in water, and is in every respect identical with the precipitate which is obtained when liquid sulphoprussic acid is boiled in contact with the atmosphere. It appears to be composed of prussic acid, combined with twice the proportion of sulphur which exists in sulphoprussic acid. That it is a hydracid, and not an anhydrous combination of sulphur and cyanogen, is proved by the circumstance, that when we heat it with potassium, a combination, accompanied by ignition, ensues between the two substances, hydrogen gas is evolved, and the compound which remains consists of a mixture of the sulphuret and sulphocyanuret of potassium.

To be continued.

MISCELLANIES.

Burnet's Theory of the Earth.—The theory, or rather hypothesis, of this ingenious but fanciful philosopher, begins by laying it down, that chaos was a dark fluid mass, composed of a mixture of every substance in the earth, without form or order. This contained the materials and ingredients of all bodies, and was in fact the elements of air, water, and earth, mingled together, without any order, and in one general confusion. When gravity began to act, the first change that would happen would be, that the heaviest parts would sink towards the centre, and the rest would float above. These heavier parts would, by degrees, harden and consolidate, and thus make the central nucleus of the earth. The rest of the mass would also be divided by the action of gravity into two orders of bodies, the one consisting of all kinds of liquids, the other volatile like air. Thus the liquid mass would form a broad ring, encircling the central nut of solid matter, and over that would be another more expansive ring of air. The liquid ring would form for itself, by the separation of the watery and the oily parts, a cream which would swim on its surface; and in the vast tracts of air, an immense number of the more light and active particles of matter would be floating about, but would at length sink and form a sediment. This sediment, falling upon the oily and creamy surface of the watery ring, would soon incorporate with it, harden, and form a solid crust. These particles, at first scattered over the regions of air, would of course fill the space that chaos had occupied, and would consequently be of great extent when they thus fell together, and came to be collected and amassed, would constitute a body of very considerable thickness and solidity. That part of the air which still remained volatile would form the atmosphere, and the crust of which we have been speaking, the habitable surface of the globe, and the bed of vegetation, so that the earth would be formed something like an egg, where the yolk corresponds to the central body, the exterior crust to the shell, and the abyss of liquid which lies beneath to the white. This is the mere skeleton of the theory.

It would be impossible to do more than allude to the variety of arguments, and the crowds of authorities he brings to support every part of it. One grand convenience of this system is, that it renders the difficulties relating to the deluge of very easy solution, though it is very true that this is only shifting the burthen upon the hypothesis. It will be readily seen, that should the action of any cause whatever impair the exterior ring of the earth, and cause it to give way, itself and all upon it must be precipitated into the liquid ring beneath. And this Burnet actually supposes to have taken place at the deluge, in consequence of the combined effect of the water below the rind, which sucked and exuded through it, and the heat of the sun which broke it into clefts and fissures.—*Scientific Gazette.*

Boron.—The easiest and most economical method of preparing boron is to decompose an alkaline borofluate by potassium. Boracic acid, even by protracted fusion, cannot be completely deprived of water, and it absorbs an additional quantity during pulverization; this is the cause why the reduction of boracic acid is accompanied by a rather violent detonation, and why a portion of the mixture is in general projected from the crucible. On the contrary, when the borofluate of potash has been sufficiently dried, the sound at the instant of the reduction is scarcely audible, and for every atom of potassium expended we obtain the corresponding quantity of boron. The only inconvenience attending this operation is the tedious edulcoration which is requisite in order to remove the undecomposed borofluate of potash: perhaps this advantage might be obviated by employing sodium and the borofluate of soda. The boron must be washed with a solution of sal ammoniac, and finally with alcohol; because when pure water is employed for this purpose, a considerable portion passes in a dissolved state through the filter.—*M. Berzeluis on Selicium.*

Sulphuret of Boron.—Boron is capable of forming a sulphuret, but, contrary to what has been hitherto supposed, no combination takes place between the two substances, except in a temperature greatly exceeding the boiling point of sulphur. It takes fire and burns, when strongly ignited in the vapour of sulphur. The sulphuret is a white opaque mass. When put into water, it is rapidly converted into sulphuretted hydrogen gas and boracic acid; the liquid at the same time becomes more or less milky, in consequence of the precipitation of sulphur. I am disposed to think, from the observations which I have made, that boron is capable of combining in several distinct proportions with sulphur.—*Ibid.*

Chloride of Boron.—Sir H. Davy ascertained that boron, even without the application of heat, takes fire spontaneously in chlorine gas, and undergoes brilliant combustion; but he did not examine the product of the combination. I have confirmed Davy's statement; if, however, the boron be very pure, and if it has been previously ignited moderately in vacuo, no combination will take place, until heat is applied. The product of the combustion is *a new gas,* which, in contact with atmospheric air, smokes as strongly as fluoboric acid gas. It must be collected over mercury, which absorbs the excess of chlorine. This gas is colourless, and in consequence of the formation of muriatic acid at the expense of the atmospheric humidity, it has a strong suffocating odour. It is rapidly, but not instantaneously, absorbed by water, and when the proportion of the water is small, a quantity of boracic acid is deposited upon its surface. Alcohol also dissolves it, and acquires the same odour of ether, as when it has absorbed muriatic acid gas.

Chloride of boron, when mixed with ammoniacal gas, condenses and forms a salt, which may be sublimed unaltered, but which is less volatile than sal ammoniac. If the salt be moistened previously to sublimation, there remains behind a quantity of boracic acid. One volume of the gas condenses 1½ volumes of ammoniacal gas. Chloride of boron is composed of

Chlorine,............	90.743
Boron,..............	9.257

Ibid.

Protection of Ships at Sea.—The following facts, which we extract from the *Annals of Philosophy,* will sufficiently show the complete success of Sir Humphrey Davy's method of protecting the copper of ships by electro-chemical action.

The Canebra Castle, an Indiaman, belonging to Messrs. Wigram, of 650 tons burden, was protected last spring by a quantity of iron, in four portions, two on the bow, and two on the stern, equal to from $\frac{1}{100}$ to $\frac{1}{120}$ part. She has since made the voyage to India, and was for some time in the Ganges.

She appeared bright and clean during the voyage out and home; some mud collected on her bottom in the Ganges; but immediately disappeared when she began to sail. She was put into dry dock about a fortnight ago, and her bottom examined by Sir Humphrey Davy, the proprietors, and various other persons. Every part of her bottom was bright and clean, without a single adhesion of any kind, and as far as could be judged from the smoothness and appearance of the copper, it had not been at all worn by any chemical corrosion. The iron, which was about an inch and a half, is considered a sufficient protector for two voyages more.

The Elizabeth yacht, belonging to the Earl of Darnley, was protected by two pieces of malleable iron in the stern, in May last, equal to about $\frac{1}{125}$ of the surface of the copper. After being employed in sailing during the summer, she was examined in November, when her bottom was found free of adhesions of any kind, and apparently untouched. The copper was bright, and even the nails not tarnished. In the course of the summer, a few small barnacles had adhered to the rust of iron, which were easily and immediately washed off; but no weed or shell-fish had ever fixed on the copper, which appeared in the same state as when she left the dock.

Magnetic Pole.—Whether the earth possesses two or four magnetic poles is a disputed point which Professor Hansteen proposes to clear up by making a journey to Siberia, to search for and ascertain the exact site of the magnetic pole, there alleged to be situated; or, at any rate, by a careful and extensive series of experiments on the variation and dip of the needle, and the magnetic intensity in that inhospitable region, to furnish useful data for magnetic investigation, also by pendulum observations to supply some much wanted data as to the figure of the earth, and the position of places thereon, the climate and natural productions, &c. are not to be overlooked. The King of Sweden patronises this journey, which is intended to be of two or three years' duration.

Society Islands.—Improvements are rapidly going on in the arts of civilized life. At Otaheite, a sugar manufactory has been established, where sugar is made from the native cane. At Eimo, a building designed for a cotton manufactory has been erected; the machinery for spinning and weaving having been imported from England, and is to be put in motion by water power. Cotton grows spontaneously, and in very great abundance.

Barometers.—Mr. Daniell has found that air insinuates itself into the vacuum of the best made barometers, by creeping up between the mercury and the glass, and that it will insinuate itself between any fluid and any solid where there is not attraction enough for the former to cause it to adhere in a state of moisture. If any gas be confined in a glass jar for any length of time over mercury, it will make its escape, and its place be occupied by atmospheric air; whereas the same gas, if confined in water, will be preserved unmixed. Hence, the best made barometers are often studed with air bubbles. To cure this, Mr. Daniell welds a narrow ring of platinum to the open end of the tube which is immersed in the cistern; boiling mercury amalgamates itself with platinum, and adheres to it when cold, by which means the passage of the air is prevented as effectually as if the tube and the fluid were one mass of matter.

Sulphate-tri-carbonate of Lead.—M. Stromeyer has lately examined the sulphate-tri-carbonate of lead, whose composition was first pointed out by Mr. Brooke. His results, which confirm the conclusions of the latter gentleman, give, for the constituent elements of the mineral,

Carbonate of lead	72.7
Sulphate of lead	27.3
	100.0

and it consequently consists of one atom of sulphate of lead and three atoms of carbonate of lead, as previously determined by Mr. Brooke.

Hydrate of Magnesia.—A specimen of native hydrate of magnesia from Swinaness in Unst, examined by M. Stromeyer, gave

Magnesia	66.67
Oxide of manganese	1.57
Protoxide of iron	1.18
Lime	0.19
Water	30.39
	100.00

Magnesite.—100 parts of magnesite, from Salem in India, gave the same accurate analyst.

Carbonic acid	51.83
Magnesia	47.88
Lime	0.28
Oxide of iron	Trace
	99.99

NOTICES TO CORRESPONDENTS.

Lachlan M'Lean has been received. We have likewise received A. Z.'s communication. If he could find out any method of supplying a *closed* crystal bottle with oxygen, a "method of illuminating" it "by means of internal combustion might easily be obtained."

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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> " Few things are impracticable in themselves; and it is for want of application rather than of means that most fail of success."

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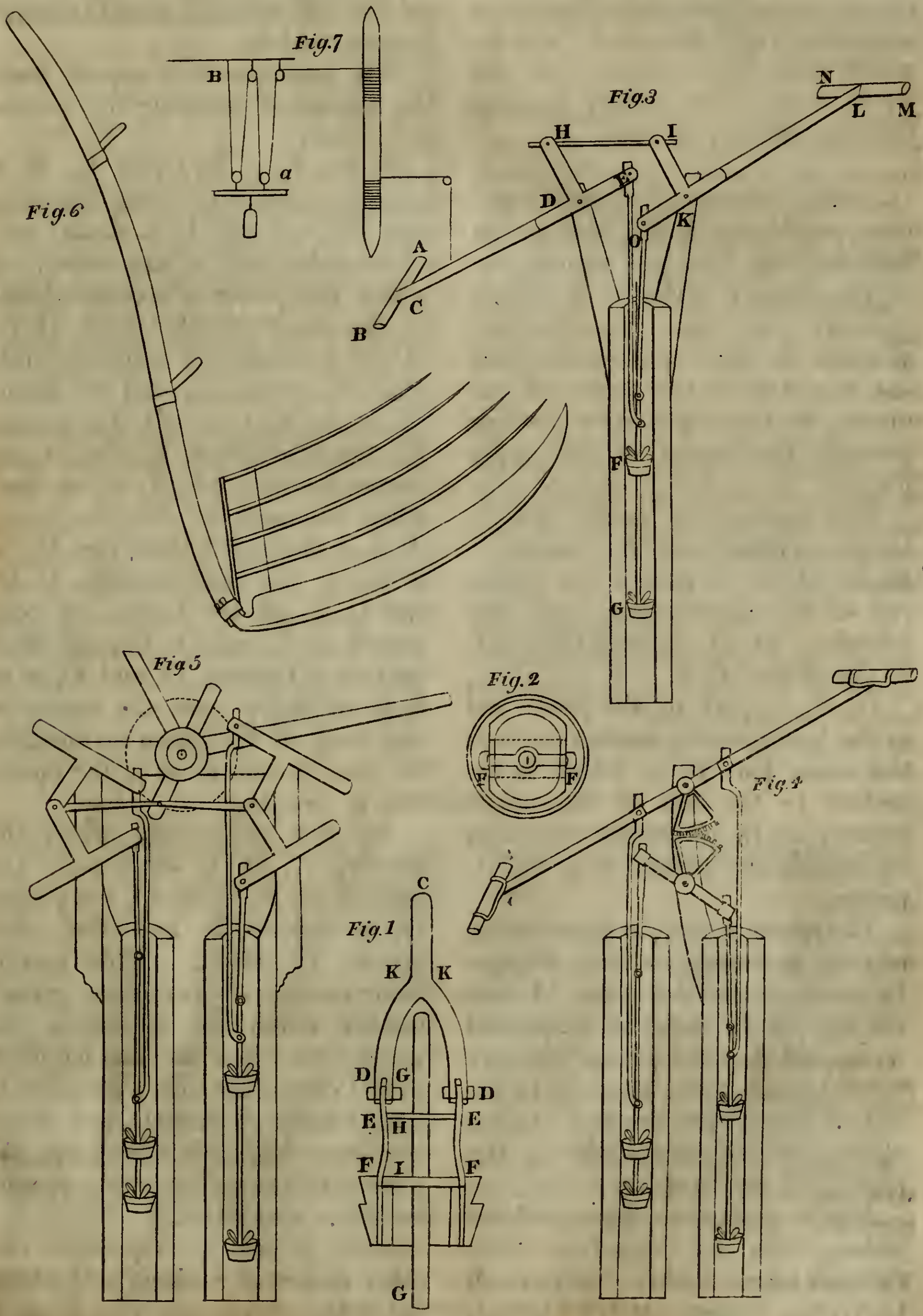
DOUBLE PISTON PUMP, &c.



— Swan —

METHOD OF MAKING A DOUBLE PISTON PUMP, YIELDING DOUBLE THE QUANTITY OF WATER FROM THE SAME BORE.

Gentlemen,—As it may be useful to some of your readers who may not have had an opportunity of seeing it, I beg to send you for insertion in your Magazine a drawing and description of a double piston pump, invented a few years ago by a Mr. Hedderwick, and for which he at that time received the silver medal and twenty guineas from the Society of Arts.

In the pumps with double pistons previously made, the piston rods has been attached to one side of the pistons, thereby giving an unequal pull upon the pistons, whereas in this contrivance they are attached to the centre of the piston, the lower piston rod passing through the centre of the upper piston.

The method of doing this is shown in figs. 1 and 2. In fig. 1, K, K, D, D, is part of the piston rod of the upper piston, with two branches, D, D, jointed at D, D, to the piston, F, F.

G, G, is part of the piston rod of the lower piston, passing through the cross bar, F, F, which is attached to the top of the upper piston; E, E, is another cross bar, by which the piston rod, G, G, passes.

The jointed piston, as here shown, is only necessary in large pumps. In smaller ones, the joint, D, and the bar, E, E, may be dispensed with, and thus the piston rod may be all in one piece, fastened to the top of the piston box at F, F, the pliancy of the rods rendering the joint at D needless.

Fig. 2, represents the top of the piston, with the cross bar, F, F, through which the lower piston rod, G, G, fig. 1, passes at I. The two valves are formed of one piece of leather, in the usual manner, which is confined under the bar or cross piece, F, F, and is strengthened by having two plates of iron rivetted upon it, one on each valve, the valves being what are usually termed butterfly valves.

The principle will appear from the manner of working the pump, as follows:

In fig. 3, A, B, C, D, H, is a handle or bent lever upon one side, and M, N, L, K, I, a similar one on the other side of the pump, by which the power is communicated to the piston; the lever, A, B, C, D, H, is moveable round the fulcrum or centre, D, and the lever, M, N, L, K, I, round the centre, K; the extremities, I, and H, are connected by a bar, I, H, so that when the end of the one lever, A, B, is depressed, the other, M, N, is raised; the straight parts, C, D, and L, K, of the levers are continued to E, and O, beyond their centres of motion, D, and K, so as to be as nearly over the centre of the bore of the pump as possible, but free of each other in the operation of working.

By this connection, when the handle, A, B, is depressed, the handle, M, N, is raised, the piston, G, is depressed, and the other piston, F, raised. This motion being reciprocally continued, gives a double advantage in lifting the water; for when the one handle is pulled down, the piston attached to that handle is raised, and when the same handle is raised up, the piston belonging to the opposite handle is also raised.

Figs. 4, and 5, represent two other modes of working this pump, but as they can be easily understood by inspection, a particular description does not seem necessary.

From the construction of this pump with two pistons, it appeared evident that the pump barrel would raise twice as much water in the same time as two others of equal bore with one piston each; a benefit of sufficient importance in many cases of accidents at sea, but upon a comparative trial before the Committee of Mechanics connected with the Society of Arts, it turned out, that the pump with two pistons actually raised *twice and a half* as much water as another pump with one piston only, which was connected with it, so as to make equal strokes therewith, did in the same time; a difference in favour of the pump with two pistons so remarkably great as to occasion doubts in the minds of the Committee, whether the pistons or bore of the double piston pump might not have been more accurately formed than in that with a single piston; on this account they shifted the pistons from the one barrel to the other; but on repeating the experiment the result was the same as before; a convincing proof that the experiment was a fair one, and, in fact, the difference in the effect of the two pumps can be perfectly well accounted for, by the consideration, that in the pump with a single piston, the water, after being put into motion by the action of the pump, is suddenly stopped by the change of motion during the descent of the piston, and has to be again put into motion at every stroke of the pump, to the great hindrance of the regular discharge of the water; whereas in the pump with two pistons, the flow from it is nearly continual during its action, the one piston constantly ascending whilst the other is descending, and the momentum of the water continuing its ascent during the change of motion in the pistons, and thus producing the very great difference in favour of the performance of the pump with two pistons; neither does this pump ever require double the force that is applied to one with a single piston to work it, it being much easier to continue a motion when commenced than to renew it perpetually when interrupted, as it is in the pumps with one piston only.

In the hope that this may prove of advantage to some,

I am, yours, &c.
A Friend to Mechanics.

IMPLEMENT OF HUSBANDRY USED IN AMERICA, CALLED "THE CRADLE."

Gentlemen,—The description, in your valuable Miscellany, of the Hainault Scythe, has suggested my sending you the following extract from private notes of a tour through New York.

The most remarkable of their implements of husbandry is that termed the *Cradle,* (see fig. 6.) It is used entirely for cutting wheat and rye, and is nothing more than the ordinary grass scythe, with four light pieces of wood attached to it termed *fingers,* which are about six inches apart, and run parallel with the blade. In the act of cutting with it the straws fall upon the frame, from whence they are not dislodged till the instrument has reached the latter extremity of the *swarthe,* or sweep. Its advantage consists in keeping the straw uniform, and affording a ready facility of forming it into sheaves. An able bodied man will go very nearly as quick through a wheat field with the cradle, as through a grass meadow with the scythe, and a man or two boys are able to rake and bind after him. The rocking motion requisite in throwing the straws off the frame, is probably the origin of its name.

The *hook and sickle*, (Hainault Scythe,) is also used; but for wheat and rye, except when laid over by the wind, the cradle is preferred.

I am, yours, &c.

A. R.

WARPING MILL.

Gentlemen,—In No. 88 of your Magazine, I notice an answer to the Warper's query. It is an improvement of so much importance to the warper and weaver, that it ought not to be passed over unfinished as A. W. has done, either from a desire for simplicity, or from never having seen it done. His idea is certainly good, but it is merely a hint of what is wanted, for by it, as given in the Magazine, it will not warp above 70 or 80 ells; as it is evident, if the cord attached to the weight B, in fig. 4, No. 88, be single, it will only be one-fourth of the length of the other. I beg to send you what I conceive a sketch of what the plan ought to be.

A, fig. 7, is two pulleys fixed in a piece of wood, and the weight is attached to the wood at B. Other two are fixed likewise in a piece of wood. The one end of the string, at B, being made fast to the wood, any person in the line will now understand it, and will perceive its utility. I consider it an improvement of great importance, and I am certain it would be beneficial to many warpers who are very much troubled when they happen to stop, especially with cope yarn and hand silk. This will remove the difficulty, as I have seen it tried, and it does well.

The insertion of the above in your Magazine, as the most public print of the present day, that it may be spread far and wide, will oblige

An Amateur.

Paisley, 7th Sept. 1825.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION V.

Sulphuric Acid.

This is a substance of very great importance in bleaching, upwards of two thousand tons being annually consumed for this purpose in Britain and Ireland. It is made by mixing a quantity of sulphur with an eighth of its weight of dried nitre, for affording a supply of oxygen, and burning the whole, which kindles spontaneously, in very large leaden chambers, according to a plan invented by Dr. Roebuck, and well known. The floor of the leaden chambers, some of which are as large as 96,000 cubic feet, is covered with water, in order to condense the acid as it is formed during combustion. This quantity of water is indefinite, but when it is found upon trial to have been impregnated to a sufficient extent, it is drawn off or concentrated by boiling. The time for removing it is either indicated by its assuming a black tinge, or by examining its specific gravity, which should be about 1.350 or 1.450, although it is commonly allowed to acquire that of 1.560. When the water in the chambers comes to so high a specific gravity, it refuses to absorb the gas with avidity, and could not be carried in this way to a high state of concentration. When in the boiler, again, it is equally necessary to draw it off before it becomes too much concentrated; for the boiling point of sulphuric acid always increases with its specific gravity, and its boiling point is very near to that at which lead melts; acid of specific gravity 1.848, boiling at 590°; of 1.849, at 605°; and lead melting at 612°. There is, consequently, great danger of the metal giving way, and loss would likewise ensue from the decomposition of the acid, while all the remainder would be much contaminated with lead.—Some manufacturers omit the boiling altogether, in order to avoid contamination with lead, and acid so manufactured the bleacher should always prefer when it can be procured.

After the process of boiling, it is farther concentrated in glass retorts, where it receives a greater quantity of heat for drawing off the water than in the boilers. It is one of the most ponderous fluids with which we are acquainted. It is usually sold of a specific gravity of 1.846 or 1.850, being about twice that of distilled water. When pure, it is a transparent and colourless liquid, extremely acid and corrosive, but entirely devoid of smell, and slightly viscid. It is commonly less or more contaminated with lead and super-sulphate of potash, arising from the mode of manufacturing it. The lead is taken up in small quantity from the chambers in which the combustion is carried on, and in the steaming boilers a sulphate is thus produced, and is subsequently fixed by the process of concentration. This sulphate is often perceptible in the form of a white powder at the bottom of the carboys, (sulphucid bottles,) when by any accidental cause it is precipitated. The super-sulphate of potash is sometimes fraudulently mixed with the sulphuric acid of commerce, but must always exist in it in small quantity, for after the combustion of the sulphur and nitre in the leaden chamber, the super-sulphate of potash is left as a residuum by the affinity of the potash contained in the nitre with the sulphuric acid, and is consequently taken up and held in combination. When this adulteration is made on purpose to increase the specific gravity of the acid, and defraud the buyer, the manufacturers add a strong solution of the salt to the water introduced into the lead chambers, which, in consequence of affinity, readily unites with the acid when it is fermenting. When this adulteration is in considerable proportion, and it is frequently as high as a fifth of the whole, the acid is rendered wholly useless for bleaching. This should put bleachers carefully on their guard in making purchases.

It may not be improper to mention, although it could scarcely be practised on a large scale, that those impurities can be precipitated by adding distilled water to the adulterated acid, and this again may be removed by evaporation. This might perhaps be turned to account in examining the quality of acid about to be purchased. A method has been proposed by Mr. Accum, (Nich. 4to Jour. I. 118,) to detect the several impurities which contaminate sulphuric acid. He directs to dilute a small quantity of the acid to be tried with distilled water, and to saturate it with pure vegetable alkali, which will precipitate either copper, iron, or lead, in the form of a more or less dark coloured powder. This is to be separated by the filter, and washed with distilled water, treated with pure ammonia, which, if copper be present, will acquire a blue colour. This blue liquid is to be poured off, and the residuum washed in distilled water and dissolved in pure muriatic acid. To ascertain the presence of lead, mix this solution with an equal quantity of water impregnated with sulphurated hydrogen gas, which, if the acid contains lead, will throw down a black or dark brown precipitate. Iron may be detected by prussiate of potash or tincture of galls. Potash is more difficult to discover: strong ardent spirits will precipitate it if it be not, as is seldom the case, in small quantity, in the form of a white powder. Or a portion of the acid may be saturated with carbonate of ammonia and a little tartaric acid added to the solution, when the potash will be indicated under the form of a tartarite.

I believe it is not common for bleachers to be incommoded by the freezing of sulphuric acid, but it is proper that they should be aware of its liability to freeze. The circumstances attending the freezing of this acid were first distinctly related by Mr. Kier, in the Philosophical Transactions for 1787.—Whenever such an accident happens to the manufacturer, it is a proof that it has not been sufficiently concentrated. In winter, then, when a bleacher has much sulphuric acid on hand, he ought to be very circumspect in bringing it to a proper state of concentration. The specific gravity of 1.730 is the middle point of the degree of easy congelation. At 1.790, or 1.770 of specific gravity, it will not freeze even in melting snow. In severe winters, then, we may infer that it would not be safe to keep the acid in glass vessels at any specific gravity between 1.720 and 1.790. Parkes relates an instance (Chem. Ess. II. 457) in which this property of the acid defeated, most effectually, the fraudulent designs of the manufacturer. Parkes had instructed him in the method of rendering the acid pellucid without subjecting it to concentration in the glass retorts. Exulting in the important discovery, he immediately prepared for his customers a hundred carboys of the requisite transparency but much diluted and weak. It happened to be winter. A severe frost ensued. The acid was within the limited degrees of freezing, in which case, according to Kier, it freezes even more rapidly than water. It consequently froze, and the carboys, bottle after bottle, would have burst by expansion, had they not been placed in tepid water.

A bleacher who may be only in his rudiments of chemistry, when he is taught that sulphuric acid has so strong an affinity for water as to attract it even from the atmosphere, will be apt to be alarmed for having his acid spoiled by keeping; but it is only when it is much concentrated that it attracts much water. It follows the general law of chemical combination, that in proportion as the point of saturation is approached, the attraction is either weakened or is slower in its action. Besides, it is always used in a much diluted state in bleaching, and, therefore, the subject of his alarm can only be well founded in the case of making a purchase. A bleacher ignorant of chemistry, would not likely give any credit to this doctrine of the acid's absorbing water. He might be readily convinced by dipping the bulb of a thermometer in the concentrated acid, which will not probably affect the thermometer; but on withdrawing it, the small portion of acid which adheres to the bulb will absorb water from the atmosphere with so much rapidity, particularly in damp weather, that in a few seconds the mercury will rise several degrees.

There is another circumstance, the knowledge of which, slight as it seems, may sometimes be of use in saving time, namely, that sulphuric acid, when heated, has a remarkable property of retaining its caloric, or of imparting it more slowly to the bodies around it than other substances generally do.—Now the violent heat which is produced on mixing the acid with water, would, in the case of water alone, split any glass vessel into which it might be poured. But in consequence of this property of retaining caloric, it may be poured with perfect safety from the retort into the carboys, at the temperature of 200°; there need be no delay, therefore, in waiting for its cooling, from apprehension of breaking the bottles.

In diluting sulphuric acid for bleaching, care should be taken to add the acid to the water, and not the water to the acid; for if the latter is done, part of the mixture will fly up and endanger the face of him who may thus act so incautiously. It is best to hold the neck of the carboy under water, when the acid will leave it from its superior gravity. The acid should be added gradually and in successive portions, and be suffered to rest a sufficient time between each addition, that a complete union between the acid and the water may take place; as, even when cold, a mixture of the acid with water takes several hours to arrive at a maximum of condensation.

It is a great desideratum with bleachers to have a ready method of ascertaining the real quantity of acid in that which is diluted. The readiest mode that can be had recourse to is the tables published in Parkes' Chemical Essays, which I content myself in the meantime with merely referring to. One of those tables shows how strong sulphuric acid should be at every degree of temperature.

I may mention here a remark that may be found to be of importance in constructing extensive bleaching works, namely, that the fumes of sulphuric acid will soon destroy the beams and rafters of the house where the souring process is carried on. Bricks, therefore, are recommended for building such a house. If wood is used, it ought to be well defended by several coatings of the pyroligneous acid. This is gently heated in an iron pot, and put on with a brush. —(Parkes, II. 274.)

Sulphuret of Lime was strongly recommended as a detergent by Mr. Higgins of Dublin, in a work which he published in 1799, on the Theory and Practice of Bleaching, but it does not seem to have ever come into general use. It was tried also in several of the bleaching establishments in France, but was laid aside after the publication of several accurate experiments on it by Citizen Potel of the Academie of Dijon, who proved that it could not be of any use in bleaching without admixture.—See Phil. Mag. XIV. 199.

MENTAL PHENOMENON.

We are, to a much greater extent than all are aware, or many inclined to believe, the creatures of imagination in our physical not less than in our mental conformation. Of this truth I have long been convinced, and have often derived instruction, I should hope, and amusement, I am certain, from the observations which this belief has led me to make upon circumstances which would otherwise have appeared too trivial for a moment's notice. Frequently when thus engaged, I have been conscious of the influence of that power being actually an element in the conclusions to which I came, even though assisted by the more direct application of perception in general, or observation in particular. It has deceived me, if I may so express myself, even while I was aware that it was doing so.

A very remarkable instance of this occurred to me the other evening, which, as it admits of many more methods of explanation than the one I have indicated, namely, an hallucination, may perhaps exercise the ingenuity of your Correspondents.

I had, to a late hour, been attentively engaged in reading upon a subject which certainly had no sort of connection, immediate or remote, with musical intonations, yet, when wearied, although not sleepy, I laid myself down in bed. I had no sooner composed my head upon the pillow, than I heard distinctly proceed from the feathers with which it was stuffed, a regular succession of sounds, varying in duration and intensity, and at last, to my astonishment, on closer and more attentive listening, (for I was now completely roused,) assuming the gradations of a popular and beautiful air. I asked of myself—can it be the motion of my body sympathising or keeping time with the air that occasions, by its vibrations, these sounds? But I had been thinking of no musical cadences, and even had to listen till the tune had closed, as it were, before it struck me that the successive beats, for such they were, however faint and slow, which I heard, constituted an air. It was not my breathing merely which occasioned the sounds by a sympathy betwixt its inspirations, and the *idea* or recollection of a strain floating in the sensorium; for they ceased not when I suspended my breathing to watch them. How, then, were they occasioned, since even my "suspirations," as far as I could perceive, had in them nothing musical? That the feathers themselves, although electrical, could *originate* musical sounds, was altogether out of the question, and to trace the chain of communication betwixt a mental sensation of which I had been unobservant, and that bodily motion with which my frame had sympathised without my consciousness, was a matter of some curiosity and nicety. The only method that then struck me by which I could do so, was by lying down again, and for a moment directing my thoughts to some well-known air, *without permitting myself audibly or by motion to follow its cadences,* and, during the process of volition, to note whether the body, by any movement, however slight, accompanied the thought. This I did. A favourite tune was recalled to my mind. I withheld from "accompanying" it. I watched with the utmost care the vibrations of my body, and I listened to my breathings, but in neither could trace any connection with the abstract idea with which my mind was then occupied; and yet the low and not unpleasant sounds from my pillow gave me the notes of the air precisely as if they had been faintly beat upon a board with the finger tips! Is, then, the electrical condition of the frame, as compared with that of objects in *contact with it*, connected by some invisible gradations of mind and matter with the immaterial sensations of the soul? But your limits forbid me asking any more questions, although many suggest themselves.

I am, &c.

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GLASGOW MECHANICS' INSTITUTION.

MR. JOHN DEUCHAR, M. W. S., late private lecturer on chemistry and mechanics in Edinburgh, who has been elected lecturer on these branches of education in the Glasgow Mechanics' Institution, intends commencing his first course early in November; and it gives us much pleasure to learn, that, previous to this, he intends to deliver a lecture, from the proceeds of which it is intended to purchase premiums to be afterwards awarded to those of the students who may distinguish themselves by their attention, application, and success, during the ensuing session. This is excellent. We have long thought that something of this kind was necessary to complete the arrangements of this fine establishment; and now that it is to be adopted, we hope the lecture will be so productive as that various handsome premiums may be offered, to excite the emulation of our young mechanics to excellence in their respective callings.

ABERDEEN MECHANICS' INSTITUTION.

THE Aberdeen Mechanics' Institution was formed in October 1823. The number of members for the first year was upwards of 500. A course of lectures was delivered by Drs. Knight and Henderson, of Marischal College, the former on Natural Philosophy, and the latter on Chemistry. These were delivered on alternate nights. A course of lectures on Electricity, Galvanism, and Optics was afterwards given by Mr. Ramage, Treasurer, and on Geometry and Geography by Mr. Elgin, Secretary to the Institution.

In the present year, upwards of 400 members have attended the lectures of Professor Paul on Natural Philosophy, who will be followed by Dr. Forbes on Chemistry, both of King's College. All these lectures have been given gratuitously.

Shortly after the formation of the Institution, a library and a collection of models and apparatus with specimens of work by various members, were formed. These have been enriched by a collection of valuable books in various departments of science, given by Mr. Thomas Bannerman, President for 1823–4, and also by various models and specimens presented to the Institution by other members. His Grace the Duke of Gordon has also presented the Institution with a donation of twenty guineas. The library now consists of upwards of 800 volumes.

In consequence of some of the original founders of the Mechanics' Institution, having considered some expressions made use of, in the course of several meetings, relative to the acceptation of the word "Mechanic," and a classification of members which provided a majority of the Committee to be "workers in stone, wood, or iron," as unjust and disrespectful, they formed themselves into a separate body, and took the name of

The Aberdeen School of Arts.

Soon after the formation of this Society, a correspondence was commenced with Mr. Steele, then lecturer to the Glasgow Mechanics' Institution, which terminated in Mr. Steele being engaged to deliver the same course in Aberdeen which he was then delivering in Glasgow. Mr. Steele accordingly commenced his course in June 1824, and had proceeded nearly to the middle, when a severe illness compelled him to return to Glasgow. This occasioned a lapse in the course, which was not resumed till the beginning of January 1825. The number of members who attended the above course was nearly 400.

On the expiry of the past year, a general meeting was held, when it was proposed that an attempt should be made to form a junction with the Mechanics' Institution, since the object they had in view by separating from that body had been in a great measure attained, as was apparent by the substitution of "tradesmen," in place of "workers in stone, wood, and iron," in the printed rules and regulations of the Mechanics' Institution. This proposal, however, not meeting with the approbation of a majority, it was agreed to continue the Society for another year. A course of lectures on Botany was delivered in June last by the Rev. Samuel M'Millan. The number attending this class did not exceed 100.

IMPROVEMENTS ON GENERATING STEAM.

To John Theodore Paul, *late of Geneva, but now residing at Charing Cross, Westminster, in the County of Middlesex, Mechanist, in consequence of a communication made to him by a certain Foreigner, residing abroad, for certain Improvements in the Method or Methods of generating Steam, and in the Application of it to various useful purposes.*

[Sealed, May 13th, 1824.]

This invention is a mode of generating steam of high pressure, by passing water through a long contorted pipe enclosed within a furnace; by which contrivance a greatly extended surface is exposed to the action of heat, and steam of very high pressure produced with great rapidity.

It is proposed to place a long metal pipe of small diameter round the furnace, and to force or inject water into one end of it, by means of a pump: which water is to be allowed to escape at the other end of the pipe, in the form of high pressure steam. The requisite length, capacity, and strength of the pipe, of which the boiler is to be formed, will depend upon the engine it is intended to work. For an engine of two horse power, the pipe should be one hundred and fifty feet long, having its internal diameter at least three-sixteenths of an inch, and if of copper, about one-sixteenth of an inch thick. This pipe is to be heated throughout its whole length nearly to redness, when the water injected at one end will escape at the other end in the state of steam, equal in pressure to about one hundred and fifty pounds upon the inch.

In constructing a boiler upon this principle, it is proposed to make a conical vessel of sheet iron, as an external casing, the broad end of the frustrum downwards; round the inside of this vessel, the pipe above described is to be coiled, and supported by flanges. A portion of the pipe, at the lower part of the vessel, is to be bent, so as to form the grate bars, upon which the fuel for heating the boiler is to be deposited, and the fuel may be introduced from the chimney at top, or otherwise, as may be found most convenient. A reservoir of water must be placed contiguous, and a forcing pump for injecting it into the pipe; and it is proposed to coat or cover the outer case with brick dust or coal ashes in order to prevent the radiation of heat.

The fuel being ignited, as in ordinary furnaces, the forcing pump is put in operation, which injects the water at the lower extremity of the pipe, so that as it rises through the conical worm, or contorted pipe, the water may become more and more heated, until it expands into steam; and this steam, as it passes through the upper part of the coil, continuing to receive additional heat, ultimately escapes at the end of the pipe with great elastic force, in which state it proceeds to the engine.

For constructing the boiler of a steam carriage, where a chimney cannot be conveniently employed, another disposition of the worm pipe is proposed. In this boiler, the pipe is to be coiled in the form of two frustrums of cones, of different dimensions, placed concentric; the larger, or outer cone, having its wider part at top, and the smaller, or inner one, its wider part at bottom. The continuous coil of pipe, thus formed into two cones, is to be fixed firmly upon suitable supports within the casing, which must be double, and the space between filled with coal ashes, or brick dust, or any other imperfect conductor of heat, as in the former instance. The fire is made at the lower part in contact with the pipes, and the bottom of the casing is to be formed into a funnel shape, for the purpose of receiving the cinders and dust which fall from the fire, and conducting them to an ash pit below. In this funnel an aperture is made, and a pipe inserted, which conducts a gentle current of air to the furnace, in order to keep up the fire, and consume the smoke; the current of air may be produced by bellows, or by a wind hole, as may be found most desirable; and the fuel may be supplied from an air-tight box above, or by any other suitable means. The injecting pump is to be applied to one end of the pipe, as before described, and the high pressure steam allowed to escape at the other end, for the purpose of working the engine. The carbonic acid, or other vapour, which is not destroyed by passing through the fire, is allowed to descend through the passage to the ash pit, and to escape into the open air.

The specification concludes by saying, that for supplying engines of greater power than those above contemplated, more than one pipe boiler may be employed, and these may be heated either in the same way as above described, or in separate furnaces; they may be heated either by immediate contact with the ignited fuel, by the radiant heat from it, by the flame emitted, by the burning of gas, by heated air, or by any other fit and convenient means. The size, shape, or construction of the furnace, may also be varied considerably, according to circumstances, as may likewise be the arrangement of the coils of pipe, provided that the boiler consists of one entire or continuous pipe, or several pipes united together, so as to form one continuous passage from the end where the water is injected, to that where the high pressure steam rushes out. The pipes may be made of any other suitable material besides copper, but their substance must be varied accordingly. The exterior surface of the pipe may be coated with a layer of fire clay, or any other fit material, to guard the pipe against the effects of the fire, and to prevent oxydation.

[Inrolled, November, 1824.]

IMPROVED MODE OF MAKING CAST STEEL.

To John Thompson, *of Pembroke Place, Pimlico, and of London Steel Works, Thames Bank, Chelsea, for his Improved Mode of making Refined, or what is commonly called Cast Steel.*

[Sealed, 9th Dec., 1824.]

This improvement is said to consist, first, in substituting for the upright furnaces, usually employed in melting steel, an air or reverberating furnace, or what is commonly called a puddling furnace, subject, however, to such variations in dimensions, as will admit the melting pots about to be described; and secondly, in the construction and disposition of such melting pots, which are not intended to be removed from the furnace, but to be tapped, and the fluid metal allowed to run out immediately into the moulds.

The bottom of the furnace is to be built solid from the ground, and one or more melting pots, or troughs fixed within, in such situations as to be enveloped by the fire. The form of the melting pots is to be semi-cylindrical, about two feet nine inches long, and twelve inches diameter, with hemispherical ends; they are to be made of Stourbridge clay, or fire-stone, about an inch and a half thick, but need not be precisely limited to those dimensions. These troughs are to have covers of similar form, which must be made fitting exactly into grooves, or rebates, on the top edges of the trough.

These troughs are to be placed across the furnace, inclining a little towards the discharging side, and a small hole is to be made near the bottom of each trough, to receive a socket made of platina, to which a pipe, or tube of fire-clay is to be joined, and this tube passed through the brick work to the outside of the furnace. Several of these troughs may be built within the furnace, with pipes extending to the outside, and the external apertures closed with clay, until it is necessary for the fluid metal to be tapped, which is done by introducing the point of a long rod, tipped with platina, into the hole, when the metal is allowed to flow into moulds placed near the top hole.

It is recommended, that these furnaces should be kept going day and night by two sets of men, changing at suitable times, and that the trough should never be removed while sound, in order that no loss of fuel may arise by allowing the furnace to cool, and which will also greatly reduce the labour and expense of working.

The patentee concludes his specification by stating that the invention consists, "1st, In employing a reverberating furnace, instead of an upright air furnace, by which pit coal can be used instead of coke. 2d, In a trough or vessel, for melting in such furnace, the necessary materials for making refined steel; and instead of crucibles, I employ my troughs or vessels, and by tapping and discharging their contents of fluid metal, while they are in the furnace, into the desired moulds, and never removing the troughs while they are capable of performing their duty. These are the primary means by which I have performed and constituted my improved mode of making refined or cast steel."

[Inrolled, February, 1825.]

APPARATUS FOR MEASURING THE DISTANCE A CARRIAGE TRAVELS, ADAPTED TO A GIG.

Mr. Edgeworth has communicated to Dr. Brewster a simple contrivance to be attached to a carriage, for measuring and denoting the distance a wheel has travelled over. He says, "there have been a variety of machines applied to carriages, for counting the revolutions of the wheel, and thus measuring the distance travelled over; but all that I have ever heard of wear rapidly and get out of order, as the machinery is placed on or near the axletree, on parts of the carriage that are subject to jar.

"For this reason, I was determined to suspend on the body of the carriage, which was on springs, all the machinery requisite for registering the revolutions of the wheel. I availed myself of R. Gout's patent pedometer, which is of little accurate use in the pocket, worn as a watch, for counting the number of steps in walking.

"I placed this pedometer horizontally in the elbow of the gig. It was there secure, concealed by a little door covered with cloth, so that the dial-plate was not easily discovered, except by a person who knew the opening. The difficulty in the machinery was to communicate motion to the pedometer, which being in the body of the gig, and of course on springs, was subject to constant alteration of distance from the wheel; but as the springs played in nearly a perpendicular direction, I passed through the side of the gig an upright spindle, which came some inches below the axletree. The lower end was bent in a crank shape, and this crank came in contact with a pin of about half an inch diameter, that was driven into the nave near its circumference.

"Round the spindle there was a helical spring, which slightly urged the cranked part against the axletree, but every time the wheel revolved, the pin in the nave pushed the crank out for a few inches from the axletree, and it returned to its place by the action of the spring as the pin receded. On the top of the spindle was placed a lever of about two inches long, a little above the level of the pedometer; this acted against the short perpendicular arm of a crooked lever, the long horizontal arm of which lifted up the handle of the pedometer, and by this means caused the hand to advance one division on the dial-plate. Now, this horizontal arm was elastic, and allowed the motion communicated from the nave to be much more than was necessary for raising the handle; the elastic lever was also bent by the motion, so that no jolting should cause any variation in registering the number of revolutions. In fact, this idea of allowing by elasticity an overplus of motion, and of placing the whole machinery on springs, are the only new principles in this little contrivance.

"It will be best to have a mile measured accurately on a straight road; then, by driving backwards and forwards a few times, and taking the mean of the number of revolutions which the wheel performs in the mile, a table can easily be formed for any carriage, whatever may be the size of the wheel, showing the value of the revolutions in miles, furlongs, and perches.

"When the roads are in good order, there will not be found a difference of one revolution in five hundred, or not one in the distance of a mile.

"It is curious, that, in wet weather, it always shows a smaller measure than the true, from this reason—that the tire of the wheel becomes lined with mud, which, in fact, adds to the size of the wheel. When the mud is very stiff and adhesive, there is a difference of one in two hundred. Measuring with the wheel of a carriage is more accurate than with the common wheel odometer, the carriage wheel being larger, and the load that it supports preventing the possibility of its slipping, and also tending to prevent the jumping that takes place when an unloaded wheel meets with any obstacle. The dial-plate of this pedometer admits of travelling more than twenty miles before the long hand makes a complete revolution, and the distances can be seen by mere inspection without stopping the gig.

"I tried this machine during five years of constant travelling, while I was employed on the survey of Roscommon. It remained in good order, and I found it saved me time in supplying any little omissions in the maps of my surveyors.

"This machine has also been used by a friend in London for some years, and he has found it remain free from sensible wear."

STREET AND ROAD PAVEMENTS.

[From the Scotsman.]

It is the practice in Vienna and some other cities, to pave the open courts of the hotels with blocks of hard wood a few inches long, set on edge, over which wheeled carriages roll almost without noise. We think a hint might be taken from this practice for paving our suspension bridges. A stratum of road metal four or five inches thick, laid upon one of these bridges, will nearly double its weight, and render much additional strength and cost necessary. Were short blocks of hard wood substituted for the stone, *two-thirds* of the weight would be saved, and also two-thirds of the additional expense which a stone road would occasion.—Were the pores or tubular cavities of the wood, previously filled with a calcareous or other stony solution, or even with pitch, its hardness would be a good deal increased, and its durability still more, by the exclusion of the water. As broken wood would answer for this purpose, and as the labour of cutting and laying would be comparatively small, we do not think the expense would much exceed that of M'Adam's road metal. We have often wondered indeed that the Vienna wooden pavement is not adopted in some of our most fashionable streets, such, for instance, as George Street, York Place, or Heriot Row, where the noise occasioned by the constant passing of coaches must be felt as a serious nuisance. Were the paving of each street under the management of the proprietors, we have little doubt that improvements of this and other descriptions would be introduced.

Even in the hard pavement of our streets we are convinced that great improvements are practicable. We may perhaps by and by offer some suggestions on this subject; but in the mean time we extract the following account of the ancient Roman and Modern Continental pavements from a letter recently published in the Morning Chronicle.

On Pavements.

Of the ancient Roman paved roads, such as the Via Appia, the Sabina, the Flaminian, Emilian, &c., there are still many miles in perfect repair in Southern Italy, especially in the neighbourhood of Rome. The stones composing the pavement of these roads are uniformly of basalt,* of a polyangular shape, containing, on an average, about four or five feet surface, and about twelve or fourteen inches in depth or thickness. They are all more or less slightly pyramidical, and placed with the base or broadest surface uppermost. It is by no means, in every instance, as is asserted, that these stones are laid in a bed of mortar; in many situations I have found it to be otherwise.† Neither are their edges chipped with any degree of nicety; the juxtaposition is, however, well contrived, and indeed very remarkable, for although the stones vary *ad infinitum* in shape, angles, and more or less in size, they are fitted together as though each had been expressly cut for its situation.

It is necessary to remark, that the carriages used in Italy both anciently and at the present time, are what would be deemed in England very light. It would appear that the carts of the ancient Romans were generally two-wheeled, drawn by two, or at most four, oxen. Travelling was for the most part performed on horseback or in litters carried by two mules. Chariots for travelling do not appear to have been used at all, much before the close of the republic. They were both two and four-wheeled, but not made to carry more than two persons besides the driver. They do not appear to have had any springs; the wheels were very low, and not more than thirty-two or three inches apart. So that altogether, it may be presumed they were more calculated to wear and break up the bones of the riders, than injure the pavements over which they bounced.

The pavements most similar in construction and solidity to the Ancient Roman, are the modern Neapolitan. The stones of these are also of basalt; but in lieu of being polyangular, they are rectangular quadrangles, mostly squares, generally of about four or five feet surface (two feet by two), and six inches in thickness. The sides are very accurately wrought as well as the surface, which is left as rough as is consistent with a good level. These stones are laid in a thick bed of the best Puzzolano mortar, and always so arranged that the lines of junction are never parallel with the line of road, but *cross it diagonally.* This pavement excels in evenness and level, is very permanent, but expensive and liable to become dangerously smooth, which renders it necessary, from time to time, to cut grooves on the surface. The city of Naples being admirably provided with sewers and sub-ways of the solidest construction, the necessity for disturbing the pavement very seldom occurs, so that the expense, though great, is pretty much confined to the first laying.

The pavement of modern Rome is also of basalt. The stones are parallelograms of about two cubes in length; and on being set up endways, they present about ten inches square surface. Although these stones are accurately cut and equal in size, they are simply fashioned by a few skilful blows of the hammer. More mortar is used in the construction of these pavements, than even in the Neopolitan. I have observed the bed of the best Puzzolano mortar on which they are laid, to be about a foot thick. Rome being so amply provided with the most extensive and complete sewers and subways of any city in the world, its pavements, or as it may be called, this horizontal wall, has very seldom an occasion to be disturbed.

The next kind of pavements that it may be necessary to mention, are those of Florence, of Sienna, of Milan, and some other cities of Nothern Italy. These may, indeed, be assimilated to a kind of stone rail-road, as there are particular tracks allotted for the wheels, and others for the horses. The tracks for the wheels are composed of stones of large dimensions; they are of marble, lumacular limestone, or of a very hard sand stone, most of them, particularly at Florence, weighing several tons. They are laid with much precision, in lines of about three feet broad. The spaces for the horses between these lines are paved with small stones, and are, as well as I can recollect, about four feet wide. In some of the squares, the small pavement predominates, while the lines of large stone way cross it in various directions. Nothing can be more easy or agreeable than this pavement, which is suitable to carriages of every description, without limitation or confinement.

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* The preference for basalt was so decided, that where the roads, for instance, traverse the Appenines, composed of marble and the hardest limestone, basalt has still been used, though it must have been conveyed thither at a great expense. In some instances, however, I have observed a single line of large marble or lime stone blocks applied as an edging or "curb" to the basalt. I am inclined to believe, that this exclusive use of basalt is attributable to its being, although harder, less slippery than marble or limestone. I have particularly remarked in the town of Caserta, where some of the streets are paved with limestone, and the rest with basalt, that the former alone are most inconveniently and dangerously slippery, although both kinds of stone are cut and laid in a similar manner.

† In most cases no more mortar was used than was sufficient to fill up the interstices between the stone, which interstices, from the shape of the stones, were much wider below than at the surface.

I very much doubt whether, in point of *durability*, either the Roman or Neapolitan pavements would succeed in London. Considering the pliable nature of most descriptions of mortar, I suspect that the repeated shocks of very heavy carriages would pulverise and detach it from the inferior surface of the stones, part of it would work out and the stone become loose. A further great objection to any such solid masonry pavements is, the frequent necessity of partially taking it up to lay gas and water pipes, and to repair our trumpery crumbling brick sewers.

The foregoing objections will equally apply to the modern Neapolitan pavements. The modern Roman has not the defect of being too smooth, but it has that of homogeneous solidity, which will not admit of its being perpetually displaced for the temporary purposes above mentioned. Moreover, where are we to get a sufficient quantity of such a Puzzolano mortar as is employed in Italy, with which the pavement becomes as one rock?

With regard to the pavements, or, as I have ventured to call them, the stone railways of Florence, Sienna, Milan, &c. &c., the objections to their adaption to the streets of London must also be obvious enough.—Independently of the enormous expense of such materials, such a system could never answer in streets where vehicles of all descriptions, going at every degree of velocity, have occasion to cross, pass, and run abreast of each other, over the entire breadth of the street.—Such large stones, whether of granite or limestone, would soon become dangerously smooth, their longitudinal edges would wear, and ruts proportionally be formed along them.

USEFUL RECEIPTS.

Tanning leather in cold weather.—Have an iron kettle or boiler for the purpose of containing water, with a wooden lid or cover: a wooden penstock let into the boiler through the lid or cover, and extending upwards; in one side of the penstock, towards the upper end, is a hole made by an auger, into which enters a common conductor of wood or other materials, the other end of which conductor passes over the tan vats—the steam arising from the boiler, which is fixed to an arch, ascends the penstock, and from thence passes into the conductor over the vats;—one or more wooden conductors to each vat, to be let into the main conductor, and penetrates downward into the vat, which is open at the lower end, which will enable persons to tan leather in cold climates in the winter season as well as in the summer.

To destroy Insects.—Water the trees or bushes with spring water, and shake American hellebore upon them with a common powder-puff.

NOTICES TO CORRESPONDENTS.

A. Z., Wilton; A Mechanic; S. T., &c. have been received. We have also received information as to the Dunbar Mechanics' Institution.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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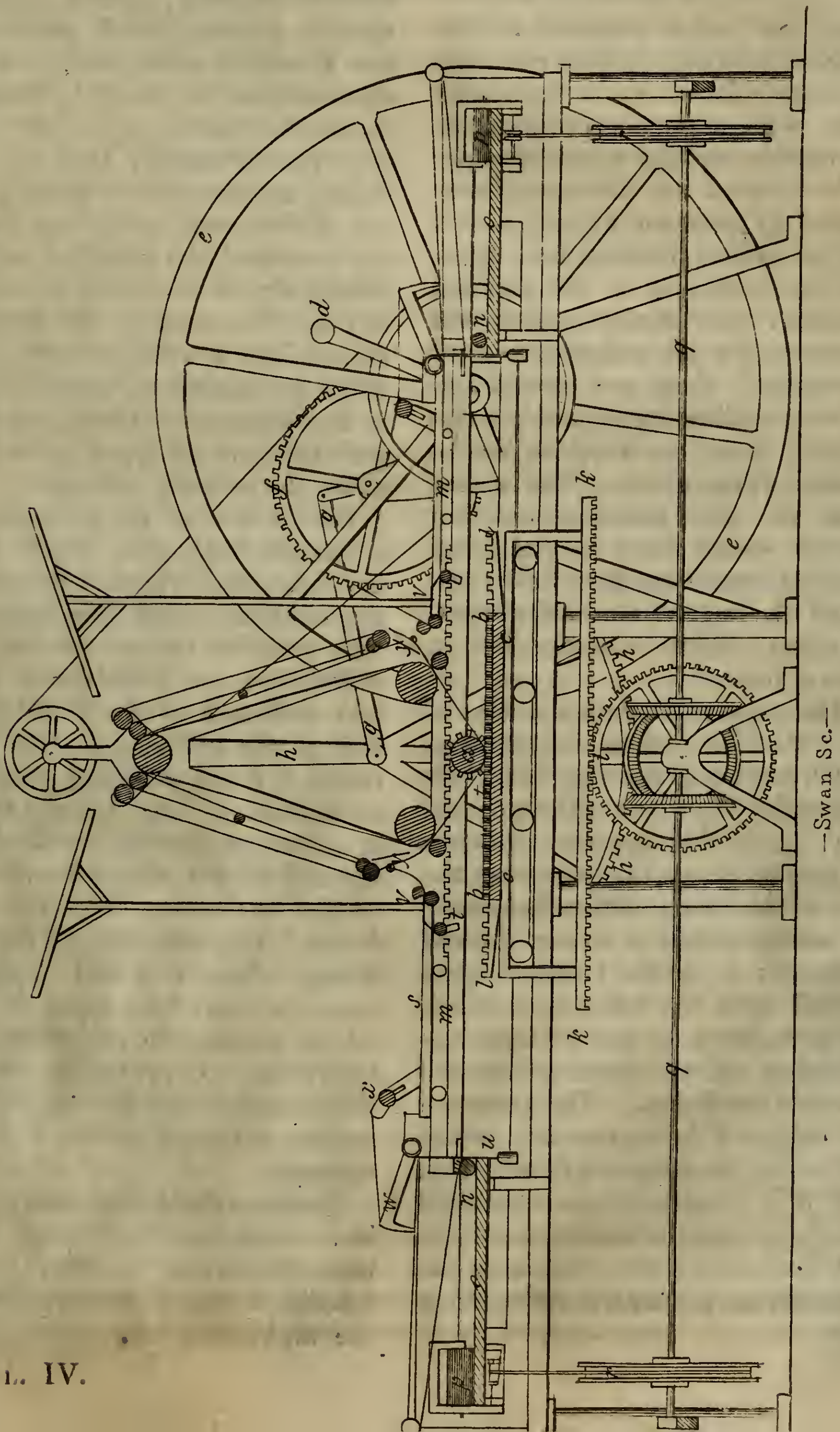
CONDUCTED BY

A Committee of Civil Engineers and Practical Mechanics.

> " Genius is praised, but hungry lives and cold."
>
> ~~~~~~~~~~~~ " What man seeing this,
> And having human feeling, does not blush
> And hang his head to think himself a man?"

No. XCIII. *Saturday*, 1*st October*, 1825. Price 3*d*.

PARKIN'S PRINTING MACHINERY.



—Swan Sc.—

IMPROVEMENTS IN MACHINERY FOR PRINTING

To Thomas Parkin, *of Baches-row, City Road, in the County of Middlesex, Merchant, for his Invention of certain Improvements in Machinery, or Apparatus, applicable to, or employed in, Printing.*

[Sealed, 15th May, 1824.]

This machine is designed for letter-press printing, having one form of types placed on a traversing table, with a pressing cylinder in the middle, and the sheets of paper to be printed are alternately conducted by means of nipping rollers and an endless blanket from tympans on each side of the pressing cylinder: whence after passing over the form of types, and receiving the impression, they are carried up between endless tapes, and are discharged from the machine on to wooden tables above. The operations of this machine are but slightly varied from several other printing machines that have preceded it, but the mechanical construction differs considerably in several parts.

The plate represents a section of the machine taken length-wise, which consists of a strong iron frame supporting the whole of the mechanism; *a*, is the pressing cylinder, turning on pivots in bearings on the side of the frame, with adjustments to accommodate it to any desired pressure: *b*, is the form of types placed upon the table, *c*, *c*, which table traverses to and fro upon antifriction rollers running on the sides of the frame. The parts are all actuated by means of a winch affixed to the axle of a fly-wheel, *e*, which is mounted upon a standard on the outside of the frame of the machine, and gives motion to the mechanism in the following manner:—

On the axle of the fly wheel, there is a pinion that takes into a toothed wheel, *f*; this toothed wheel carries round a crank upon its axle, and the rod, *g*, connected to the crank and to the swinging lever, *h*, causes that lever to vibrate. The lower end of the swinging lever has a rack, formed of a segment of a circle, which rack takes into a toothed wheel below, on the same axle as the wheel, *i*; thus, as the toothed wheel, *f*, and its crank goes round, and by means of the rod, *g*, actuates the swinging lever, the curved rack at bottom causes the axle and the wheel, *i*, to turn alternately to the right or to the left, and the teeth of the wheel *i*, taking into a straight rack, *k*, *k*, which is attached to the under side of the table, *c*, *c*, drives the table with the form of types to and fro, under the printing cylinder.

On the side of the table there is a straight rack, *l*, *l*, which takes into a toothed wheel at the end of the cylinder, *a*, and there is another rack on the under side of the sliding bar, *m*, which also takes into the teeth of the wheel at the end of the cylinder, *a*; the three racks, *k*, *l*, and *m*, being parallel to each other. The inking rollers, *n*, *n*, are suspended by hooks at the end of the sliding bar, *m*, and as the bar moves backward and forward, they take the ink from the inking tables, *o*, *o*, and deposit it upon the face of the types, *b*. The ink is supplied to the tables, *o*, *o*, by rollers, *p*, *p*, which traverse across at the ends of the machine, and are actuated in the following manner:

On the axle of the wheel *i*, there is a bevelled toothed wheel, which turns two other bevelled toothed wheels on the shafts *q*, *q*, and by the alternating movement of the wheel *i*, before described, these shafts are also made to turn alternately to the right and left, and by means of band wheels, *r*, *r*, on those shafts, the rollers, *p*, *p*, are drawn to and fro across the ends of the tables, *o*, *o*, bringing supplies of ink from ductors, at the ends of their race, on the sides of the machine. The ink thus deposited upon the tables, *o*, *o*, is spread over the tables, and taken up by the inking rollers, *n*, *n*, when by the sliding of the bar, *m*, those rollers are brought on to the tables.

Let it now be supposed that by the vibration of the swinging lever, *h*, the racks, *k*, and *l*, with the table, *c*, and form of types, *b*, have been brought to the left hand of the printing cylinder, *a*, the upper rack and the bar, *m*, will by the same operation have been conducted to the right hand; this may be called the position of the machine ready for starting. A sheet of paper to be printed, is now laid upon the left hand tympan, *s*, its situation being carefully adjusted by registering points, and the machine being put in action, the racks, *k* and *l*, with the table, *c*, and form of types, *b*, now slide along the machine to the right hand, passing under the left hand inking roller, *n*, as that and its bar, *m*, moves towards the left hand end of the machine, thereby furnishing the types with ink, which is more uniformly spread upon the types by another roller near the printing cylinder.

At each extremity of the bar, *m*, there is a cross rail, connecting it to a corresponding bar on the other side of the machine, and as the bar slides back to the left, this cross rail strikes against the tail of a small hanging lever, *t*, on the side of the frame, which pulls a cord that draws the tympan forward a short distance, and places the edge of the paper between what is called the nipping rollers, *v*; at this moment the registering points of the tympan sink by a small roller upon a bar, which supports them running down an inclined plane on the side of the frame, and the advance of the tympan having drawn up a cord with a suspended weight, *u*, the friction of that cord upon a small pulley has raised the lever, *w*, which allows a roller, *x*, supported by a cord from that lever, to slide down a groove in its standard and rest on the sheet of paper, so as to prevent its moving from the adjusted position.

The nipping rollers, *v*, actuated by cords connected to the ends of the bar, *m*, now take hold of the sheet of paper, and conduct it to the endless blanket, which passes under the pressing cylinder, *a*, where the farther progress to the right of the table, *c*, and its rack, *l*, with the form of types, *b*, causes the printing cylinder, *a*, to draw the sheet on to the form, and to give it the impression as the table and types pass under. A small guide, *y*, is placed on the side of the triangular standard in the middle of the machine, for the purpose of conducting the sheet of paper, after it has been printed, to the taking off tapes. These tapes are made to run over their pullies by means of cords from the wheel, *z*, at the top, which is actuated by a band from a wheel on the axle of the fly-wheel. Thus each sheet of paper, after printing, is conducted to the taking off tapes, and is by them carried up, and ultimately deposited upon the table at the top of the machine, from whence it is removed by hand, and placed on the heap.

Having explained the operation of the machine, in conducting and giving the impression to a single sheet of paper from one end, it is only necessary to say, that the sheets are to be placed both on the right and left hand tympans, in the same way as already described, and that they are delivered alternately on to the tables above after being printed from one form; and that all the parts, and the operations of the parts of the machine, are alike at both ends from the centre; excepting that distinct machinery is placed on the side for giving motion to the whole. The machine may, therefore, be considered as a double acting printing press, but is not constructed to *perfect*, that is, to print the sheet on both sides by the same operation. When, therefore, all the sheets of paper have been printed on one side, they are again placed in two heaps, and drawn off singly, by hand, on to the tympans, the blank side of the sheet being downwards, where their positions are carefully adjusted to the registering points; and by passing under the printing cylinder, by the same means as above explained, the sheet is perfected, that is, the impression is given on both sides.

[Inrolled, September, 1824.]

ON THE NECESSITY AND THE MEANS FOR PROTECTING NEEDY GENIUS. *

The subject of this pamphlet is one which is of the highest importance, and which vitally concerns the honour of our country. We have, ever since the commencement of our little work, taken every opportunity of bringing it before our readers, and we are happy to perceive that others are taking an interest in it, and are bringing it before the public. This pamphlet, a copy of which has been sent us by a friend in London, originally appeared in the pages of the London Journal of Arts and Sciences, and although we cannot agree with many things which it contains, it is evidently written by one who has the interest of the working classes at heart. It is certainly a matter of no little wonder, and not a little to be regretted, that although this country has been raised to a degree of wealth and grandeur unparalleled in the annals of the world, and that entirely through the labour of her ingenious mechanics, so many of them have been allowed to pine in want and obscurity, the victims of their genius and their desire to benefit mankind; and we blush when we write it, that hitherto no means has been adopted, permanently to relieve their distresses.

In the pamphlet before us, the author has first shown the necessity of something being done, and afterwards he has proposed his plan of affording relief. Unfortunately, he has too much evidence to adduce to find much trouble in establishing the sufferings which the poor and ingenious mechanic has often to endure, and, consequently, the necessity of attempting to afford them relief; as we suspect, however, that most of our readers are already fully convinced of all this, it will be unnecessary to trouble them with any quotations from this part of the pamphlet, but shall proceed at once to the plan of relief here proposed.

The objects which, it appears to the author, ought to be embraced by the plans of relief, are the following:—

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* London; published by Sherwood, Gilbert, & Co.

1. To give opportunity to talent, oppressed by poverty, of freely exerting its powers.
2. To aid it, where necessary, by such instruction as will nourish and develope those powers, temper them with steadiness, and conduce to expose the fallacy of visionary schemes and mistaken principles.
3. So to protect the produce of that talent, that its possessor may derive adequate benefit therefrom.

The plan which is proposed is, that an institution should be formed, capable in itself of supplying all the wants of the poor mechanic: and he next proceeds to state the plan on which such an institution should be framed.

The first and most difficult point for consideration, is the means of obtaining the requisite funds; they must, of necessity, be great, and will be *immediately* required: for we deem it highly essential that the society should acquire *at once* that dignity and importance to which it is designed and deserves to rise; and that it should be in full possession of resources adequate to the complete attainment of its objects; for thus alone can we insure its establishment upon that firm basis which will determine its ultimate utility. Unless at its birth it stands forth, Minerva like, in full grown strength and vigour, and vested with powerful and evident claims upon universal consideration and patronage, we cannot with reason expect that it should readily overcome those difficulties which must obstruct it; and but few would be found who would firmly adhere to it, and patiently foster it, while it thus *struggled* into utility. There appear but three practicable modes of raising these funds: viz. 1st. By a loan bearing interest. 2nd. By transferable shares, entitled to a division of the profits of the institution, thus constituting it a joint stock association. 3rd. By transferable shares, which should constitute the holders thereof proprietors of the institution, and entitle them to certain privileges:—and these are all in some degree objectionable. The first would render the association most independent: but at the same time the interest of the capital required, (three-fourths of which would probably be sunk in the buildings, &c. appropriate to its views,) would oblige the institution to seek some means of emolument, beyond what it must otherwise have to meet the annual xpenditure, which would be a great drawback upon its liberality, and very much cramp its efforts in favour of those for whose benefit it is intended. The second is open to the same objections: there would still be an obligation to enact large profits for its labours, which of all things is the most carefully to be avoided. It is obvious, however, that in many instances, the party receiving aid from the society, must repay what has been advanced for him with an interest upon that advance;—for instance, where the society has obtained a patent for an applicant, they must receive the profit of it until the cost shall have been defrayed, and the society rather more than reimbursed: but at the same time, this cost should be rendered as light as possible, consistently with the interests of the institution, for the support of which the income so derived will be required.

The third method would be by far the most advantageous to the society, as a permanent capital would at once be acquired, and unfettered in its application; but by constituting the share-holders *proprietors*, the free agency of the society is in a great measure compromised, and a door is opened to that innovation which it is our object so cautiously to guard against. It is, however, the most eligible means; and as we hope to find amongst the friends of science, those who will not refuse to contribute upon such terms, we will suppose the funds to have been acquired in this manner, and proceed to explain the requisites of the society, striving, at the same time, at some means of neutralizing the objections we have raised.

We have before stated the intentions of the society:—for the accomplishment of these will be required,

1. A committee of investigation to examine schemes and inventions submitted for reward, or for the protection of patent right.
2. A work-shop and laboratory well supplied with tools and apparatus, where, under certain regulations, the members or applicants may prosecute experiments, &c.
3. An extensive museum of machines and models.
4. A library of reference, exclusively scientific, and reading rooms supplied with all periodicals upon the arts and sciences.
5. Lectures upon natural and experimental philosophy, practical mechanics, chemistry, and the arts.
6. Elementary schools for teaching the principles of the arts and sciences, as connected with the various crafts.

As it is evident that the committee of investigation must consist of men well skilled in the subjects thus offered for their examination, means must be provided for securing a sufficient number of such men to the institution. The method we have assumed of raising the funds, seems to preclude the possibility of electing the whole quota from among the proprietors; as we must, in that case, determine that a large proportion of the shares should be held by men of science, which would militate greatly against the first distribution of the shares and their subsequent transfer when requisite. It would therefore be advisable that a part only of such committee should be elected from the proprietors, and the remainder from persons *not connected* with the institution: that is, that the society should solicit persons of well-known ability to accept it as an honorary office. By this means we should be in a great degree assured against the exercise of any undue partiality by the committee; (which would be more essentially detrimental in this branch of the society;) and should collect a body of talent which could not by any other means be obtained. Inventions, after being submitted to and reported upon by this committee, should be laid before a board of directors or council, who would have full liberty to consider, and reject or confirm the report, and to adjudge the award to be conferred. This council should be numerous, and be elected, either the whole or in part, annually; the latter would perhaps be more preferable,—that is, one-half to be continued for the succeeding year, and the other newly elected.

Of the committees of investigation, that portion which consists of proprietors, should be re-elected annually, (or oftener might be advisable,) and that which we have called *honorary*, ad libitum, by the ballot of the proprietors. The meetings of the committee should be frequent, (once or twice a week,) for the examination of matters proposed for the patronage of the society; and proprietors ought not to be allowed to resist their election to the office, nor to neglect attendance at every one, at least, of the meetings, without a sufficient reason being shown, such as sickness and the like; or incurring a heavy fine: but care should be taken, by a general notice being given some time previous to the election of the party proposed, that no insufficient persons be elected to such committees. The sittings of the council might be monthly or as often as occasion required, to take into consideration, and to decide upon the proceedings of the committees.

The laboratory and work-shops are perhaps the most powerful aid we could offer to needy genius; and where he ought, therefore, to meet with every possible assistance in the way of tools and *workmen:* when inventions have been approved by the council, the inventor is here to be provided with the means of perfecting models for the society: and when crude schemes have been proposed, and are thought worth prosecuting, it is here that the projector is to be supplied with every facility for the requisite experiments, under the guidance and assistance of persons capable of affording both. The workmen whom we have here spoken of as connected with the work-shops, are highly essential: they should be selected from the mechanics who attend lectures and schools, according to the proficiency they have here attained; thus rendering it a part both of *honour* and of *emolument* to them. This would prove a great stimulus to their exertions, and create in them a most beneficial spirit of emulation, as well as a *permanent feeling of interest* in the welfare of the society. They might also be eligible to many other offices in the institution under similar regulations. Their attendance need not exceed a few hours daily, and, when their time was not otherwise employed, they could be engaged in forming models for the museum; so that, while they derived considerable benefit, the society would be amply repaid for what is expended upon them.

The elementary schools are an important feature in the plan of our society; and to render them effective, we would have them limited to the instruction of the mechanics in the arts they practise; and, as we contemplate only such crafts as are immediately connected with the mechanic arts, we do not apprehend that any difficulty would be found in carrying them into effect. By adopting a system of mutual instruction, and a careful economy in books and apparatus, they might be conducted with little trouble to the superintendents, and at a very moderate expense. Although it is absolutely necessary, for the good of the institution, that mechanics should pay *something* towards their instruction, yet, to place that instruction within the reach of all, it is equally necessary that the charge should be as low as possible,—not exceeding five or ten shillings per annum, for the lectures and the schools. This is quite as much as the generality of the working classes can afford, or will be *willing* to spare for a *continuance:* the novelty might induce them to give more at first, but when this had gone by they would begin to feel it too serious a tax.

It is of paramount importance that the greatest possible encouragement should be held out to the students: and accordingly they should be eligible to the highest offices of the institution, upon attaining a proper competency to them; and numerous honorary, as well as lucrative degrees and premiums should be established. A great help to this end would be the establishment of a weekly paper amongst them, which should report the lectures of the week, (thereby impressing them more firmly upon the minds of those who had attended them,) and be open to the communications of the members of the schools, with the remarks and replies of the editors.

This work should be distributed at a small charge, amongst the members; and possibly its circulation might be extended beyond the society, when it would become a means of some small emolument to its treasury. It should be printed by the society; for it would be advisable and requisite, for many reasons, to establish printing in all its branches. It behoves us now to speak of the sources whence the annual revenue is to be derived.—We have,

1. The interest of the funded capital, if any be thus bestowed, which we would recommend.
2. The profits from the patents obtained and held by the society.
3. The subscriptions to the lectures and schools by the mechanics.
4. The fees to the laboratory and workshops.
5. The profits of the weekly paper.
6. As it would be advisable to admit of annual subscribers to the library and lectures, there would be the amount of such subscriptions.

In addition to these the printing department might be made a means of considerable profit, if the society were to undertake to print (and it might edite also) works of certain descriptions. It is scarcely possible to estimate the probable amount of these various sources of revenue; but we would suppose, that, although small at first, when the society had risen to any consequence and useful operation, they would be considerable, and quite adequate to the proposed purposes of their application. The capital required would not, perhaps, exceed £100,000; which might be divided into a thousand or more shares: and surely, we may venture to expect that there are as many individuals in this metropolis, who would willingly come forward to support such a national and so truly valuable and necessary an institution. We have said but little of the internal management of the society; but we have laid down broad principles for its general conduct, which if acted upon in their real spirit, we think will prove a firm basis for its foundation. The remainder is the province of the "Bye Laws;" and we will only generally remark, that they should tend as far as possible to promote a cordial union between the mechanics and the upper members; give every encouragement to the former, and at the same time guard against all innovation upon either, as cautiously as though they were framed for the government of a state. Indeed, a society of this kind should closely resemble a little state, composed of every grade of knowledge, from the deepest mathematician, to the mere practical workman—and no less care should be bestowed upon its construction: for as it is easier to prevent the existence of evil, than to correct its consequences—to secure the body against disease, than to eradicate it when established; so to fix at the outset a permanent security against all abuse is infinitely more prudent, than to seek the means of *controlling* (to *destroy* is impossible) the hydra-headed monster when once he has appeared.

The principal officers of the institution would be, as usual, president, vice-presidents, &c.; and we would strongly advise, to give it that consequence in the eyes of the world, which may enable it grow at once into merited splendour and estimation, that it should be incorporated by charter, and under royal patronage.

We will not now enter into any farther detail, as our more immediate object has been to rouse the public attention, and to enliven their feelings to the first and most important portion of our paper—"The NECESSITY of protecting Needy Genius."—If we are so fortunate as to attain that end, (and for the honour of our country we sincerely hope it,) we shall be happy and proud again to enter upon this most interesting theme, and to strain to the utmost all our feeble means of supporting it; and it is our ardent wish and most fervent prayer that it might find real and kind friends among those whose experience and means the best adapt them to promote the well-being of so benevolent an undertaking; and to their generous and sympathizing hearts we leave it; confident that barely to tell of misery is to insure their kindly aid, and therefore, that we shall not have again to become the unworthy advocates for the PROTECTION OF NEEDY GENIUS.

ON HYDRACIDS AND THEIR COMBINATIONS WITH SALINE BASES.

By Dr. J. Berzellius.

Combination of Hydracids with Saline Bases.

A full exposition of the nature of the compounds of hydracids with saline bases constitutes a most essential part of the theory of these acids, because it furnishes the only means by which all the apparent inconsistencies can be reconciled. In attempting this explanation, two different views present themselves: either the hydracid unites without decomposition with the oxidated base, or its hydrogen decomposes the base, while the radicals of both the acid and base enter into combination. Of these views I consider the latter to deserve the preference; for if a solution of a salt, obtained by saturating a hydracid with an oxide, be evaporated, it very frequently happens that there crystallizes a reduced compound of the radicals of the acid and base, wholly destitute both of hydrogen and oxygen; and when such crystals contain water, that is, in the circumstances in which they may be regarded as compounds of an oxidated base with a hydracid, they frequently lose it in vacuo, or in a dry atmosphere, and effloresce exactly like substances which lose merely water of crystallization. But these compounds of the radicals of hydracids with the radicals of bases resemble so intimately the salts which are formed by oxygen acids and oxides, that they coincide with them in all their physical properties: as taste, appearance, solubility in water, and in other liquids; and it would be difficult, without offering extreme violence to natural arrangement, to class them among any other substances except the salts. Guy Lussac ascertained, for example, that if oxide of mercury be placed in contact with prussic acid gas, the latter is absorbed, and water disengaged, while the product is cyanuret of mercury. This water proceeds from the hydrogen of the prussic acid, and the oxygen of the oxide of mercury, neither of which enter into the new combination; but this compound, formerly called prussiate of oxide of mercury, possesses so close a resemblance to the salts of that oxide, in appearance, taste, and all its other properties, that the most positive evidence to the contrary would be requisite in order to convince one that it is not a salt of the oxide of mercury. I have myself ascertained, that if the ferro-prussiate of potash, that is, a combination of prussic acid with potash and oxidule of iron, be crystallized, there results a compound, containing precisely the quantity of oxygen and hydrogen which would be necessary to convert it into a double salt of prussic acid with oxidated bases; but that these crystals lose the whole of their water like an efflorescent salt, either when confined in vacuo in the ordinary temperature of the atmosphere, or when exposed to dry air in a temperature between 77° and 86°; and it is certainly a far simpler view of the phenomena to regard this water as existing in the state of mere water of crystallization, than to assume that efflorescence, which can result only from the expansive force of water already formed, should have occasioned the mutual decomposition of the base and acid. Besides, we have never been able to discover any other difference between the compound which are regarded as salts of hydracids, and those which indisputably contain no other ingredient except the radicals of the acids and bases, than that which subsists between salts with and without water of crystallization.

We adopt, therefore, in preference, the theory that *salts containing a hydracid do not exist*, but that when a hydracid is brought into contact with an oxidated base, the hydrogen of the acid combines with the oxygen of the base and forms water; while, at the same instant, the radicals of both unite mutually in their reduced condition, and the product is a substance which resembles so closely the salts of the oxidated radical of the base, that it cannot be distinguished from them in any of its physical characters. Hence, when sulpho-prussic acid, which, although wholly destitute of oxygen, possesses a strong and pure acidity, is mixed with carbonate of potash, and when carbonic acid is thereby expelled with the same degree of effervescence, which would be occasioned by the addition of an oxygen acid, the potash is decomposed by the hydrogen of the acid, and a combination ensues between sulphuretted cyanogen and potassium. If the mixture was sufficiently concentrated, it crystallizes, and the crystals contain neither hydrogen nor oxygen, but only potassium, sulphur, carbon, and azote; nevertheless they resemble a saline compound, particularly nitre, so perfectly, that they might be mistaken for crystals of that salt. In the new theory, respecting the constitution of muriatic acid, the same decompositions take place when potash or soda is saturated with muriatic acid, and all the phenomena may be consistently explained on the supposition that chlorine is a simple body so soon as we cease to maintain the existence of hydrochlorated salts, and admit that what we have hitherto styled muriates, are combinations of chlorine with the radicals of bases. For the nature of hydracids in general, we suppose that these combinations must, in every respect, resemble salts.

The acid properties of a hydracid consist, therefore, in its decomposing bases, and not in saturating them; hence it follows that the property of acidity neither belongs to the substance itself, nor results from the nature of its constitution, but merely indicates a condition opposed to the property of alkalinity. In the case of hydracids, therefore, it depends at the same instant on the strong affinity which subsists between hydrogen and oxygen, and between the radicals of the acid and the base; and this is the reason why the radical of a hydracid possesses few or none of the characters of an acid substance, because it is unable, unless aided by hydrogen, to deoxidate or decompose the alkaline bases.

This reciprocal alteration in the elementary constitution of the acid and base, takes place even in the combinations of ammonia with hydracids. Here the ammonia is converted into ammonium, by seizing upon the fourth atom of hydrogen, which forms one of the constituents of the acid; and this ammonium subsequently enters into combination with the radical of the hydracid. For example, when muriatic acid gas is combined with ammonia, yielding the compound which, according to the old theory, was regarded as muriate of ammonia containing water of crystallization, the acid undergoes decomposition, the ammonia combines with its hydrogen, and is thereby converted into ammonium, and the latter remaining in union with the chlorine of the muriatic acid, forms its chloride of ammonium. When ammoniacal gas is mixed with chlorine, a portion of it is decomposed, the azote is disengaged, and the hydrogen combining with another portion of the ammonia, forms with it ammonium, which now unites with the chlorine. Sal ammoniac is, therefore, a chloride of ammonium, just as common salt is a chloride of sodium.

The resemblance between the compounds properly denominated salts, and those formed by the radicals of hydracids and of bases, is so complete that (as I have already observed) it is impossible, without offering violence to their external characters, to regard them as belonging to dissimilar classes of bodies. Nevertheless, in a theoretical point of view, there is a wide difference between the compounds of oxidated acids and bases, and those of combustible bodies without oxygen; and it may perhaps be argued from this, that our present theory supposes arrangements which have no existence in reality. Dulong has attempted to reconcile this inconsistency by regarding all acids which contain water as hydracids. He joins the oxygen of the water to the acid, and forms with the radical of the acid and its oxygen a compound radical, which, in union with the hydrogen of the water, constitutes the hydracid. Thus he regards hydrous sulphuric acid as a compound of hydrogen with a radical composed of an atom of sulphur and four atoms of oxygen; that is, containing one-third more of oxygen than is considered to exist in sulphuric acid. When this acid combines with a metal, (potassium, for example,) hydrogen only is disengaged, and the potassium combines with the compound radical of the hydracid. The sulphate of potash thus formed, ought to be regarded as a compound, not of sulphuric acid and potash, but of potassium and the radical of the hydracid, that is, sulphur with the whole quantity of oxygen, constituting a single integrant particle. When this hydracid is placed in contact with potash, the alkali is reduced by the hydrogen of the acid, water is formed, and the potassium unites with the compound radical of the acid. Again, if this acid be mixed with ammonia, no trace of water is produced, but the hydrogen unites with the ammonia, and forms ammonium, which now combines with the radical of the acid. Now, there does not exist a single neutral ammoniacal salt which does not contain this quantity of hydrogen, that is, which, according to the commonly received theory, does not contain a portion of chemically combined water, whose hydrogen corresponds with this quantity. This explanation of Dulong's is unquestionably entitled to considerable praise; because it re-establishes the harmony in the doctrine of salts, which had been disturbed by the new theory respecting the nature of muriatic acid, and, indeed, to a still more general extent by the phenomena accompanying the combinations of hydracids.

The combination of hydracids with saline bases gives rise both to acid and subsalts. The acid salts are produced when the saline-looking compounds of the radicals of the acid and base combine with a new quantity of the hydracid, the result of which union is a body, possessed to a greater or less extent of acid properties. Such are the ferruretted prussic acid, the compound styled hydrosulphuretted alkalies, and, according to the new theory respecting the nature of muriatic acid, the acid muriate of oxide of gold. Hitherto, however, we have become acquainted with only a very limited number of these acid salts. The compounds containing an excess of base are much less unfrequent, and they are produced when the neutral compounds of the radicals of the acid and base unite with a portion of the oxide of the latter; the result being a subsalt, coinciding in all its characters with the subsalts which the same oxidated bases forms with the oxygen acids. The acid salts may be regarded as double combinations of the radical of the acid with two combustible bodies; for example, ferro-prussic acid is a double cyanuret of iron and hydrogen. The subsalts again may be regarded as double combinations of the radical of the base with oxygen, and with the radical of the acid; for example, the substance styled subprussiate of mercury is a combination of cyanuret of mercury with oxide of mercury. The existence of these subsalts appears to me to furnish the strongest argument which, in the present state of our knowledge, can be advanced in favour of Dulong's theory respecting the constitution of salts.

From what I have now stated, it is obvious that none of the compounds which have hitherto been styled prussiates, contain either prussic acid or an oxidated basis, but that they consist of cyanogen and the radical of the base: we call them, therefore, cyanurets, or sometimes metallic cyanurets. This view enables us to explain why a solution of the cyanuret of potassium possesses such little permanency, and why its taste participates simultaneously both of potash and of prussic acid. All substances which may have any tendency to combine with potash, as, for example, the carbonic acid of the atmosphere, the constituents of saliva, &c., determine the formation of that alkali by oxidation at the expense of water, and prussic acid is at the same instant disengaged.

Neither does there exist a class of salts corresponding with the name of sulpho-prussiates, because here also, as we have already seen, the acid is decomposed by the bases, and compounds are formed, which for the present may be styled *sulphocyanurets* and *cyanosulphurets*, the latter appellation being reserved exclusively for those compounds which contain cyanogen united to the larger proportion of sulphur.

BOLTON MECHANICS' INSTITUTE.

Gentlemen,—I beg to send you all the intelligence I can, as to the Mechanics' Institution in this town.

Several intelligent young men had for some time felt anxious that such a measure should be adopted, and after waiting in vain for some more influential persons to take the lead, they had began to hold private meetings to carry their wishes into effect. At length, by the advice of some friends to such an establishment, a public meeting was announced by advertisement to be held in the Sessions Room, on the evening of Wednesday the 8th of June. Previous to this, the public attention had been awakened to the education of the operative classes, by the publication of Mr. Henry Brougham's pamphlet on that subject, in one of the Bolton newspapers.

A respectable though not very numerous company of gentlemen, tradesmen, and operatives assembled at the time above-mentioned, and Richard Ainsworth, Esq. of Halliwell, near Bolton, was unanimously elected to the chair.

He opened the business of the

evening by stating the objects they were met to promote, and expressed his cordial approbation of such societies, and his desire that one should be established in the town.

A short essay on the advantages of knowledge, and the happy scientific and moral results which might be expected from placing facilities in the hands of the operative classes, was read by Mr. E. Sweetlove, one of the young men before alluded to; at the close of which, he moved that an institution be established in this town, called "The Bolton Mechanics' Institute and Library," to embrace the following particulars, as its funds permitted; a library to consist of literary and scientific books, a hall for models, sculptures, &c., lectureships on the different branches of natural and experimental philosophy, and such apparatus as is necessary to elucidate and demonstrate the sciences.

This motion was carried without a dissentient voice.

Mr. Derbyshire, Sen. then combated, at some length, the usual objections that are raised against informing the minds of the working classes in a number of very pertinent remarks.

The next step was the nomination of a Committee to carry the above resolution into effect, by forming rules for the Institution, the result of whose deliberations are to be reported to a future meeting of those who may have entered their names on the subscription lists; which includes a number of gentlemen and tradesmen friendly to science, some of them excelling in it, and of active and well-informed operatives.

Some difference of opinion was expressed in fixing the amount of the annual subscription. Twelve shillings had been agreed upon at a preparatory meeting, but a great majority of the persons present evincing a laudable desire to render the advantages of the Institution accessible to that most depressed but intelligent body of operatives, the weavers, finally determined upon its not exceeding ten shillings.

Dr. Black, in the course of the proceedings, delivered a neat and appropriate speech on the use of such institutions in expanding the mind, and enabling man to overcome the obstacles to his interest or enjoyment, by availing themselves of the powers of the elements through an acquaintance with the laws which govern them, and in opening to the operatives new channels for their energies and hopes. By these and similar institutions, their untutored genius received the advantages of education, and thus the avenues to opulence and honour were thrown open to them. He concluded by cautioning them not to expect these results without a diligent use of the means afforded them, nor, on the other hand, to spend too much of the "midnight oil" in their studies, by which they would probably unfit themselves for their manual employments, and, by disordering the body, impede the operations of their minds.

The thanks of the meeting being voted to the Chairman for his able and impartial conduct in the chair, he expressed the gratification the meeting had afforded him, promising the infant Institution the fostering care of his influence, and, he remarked, what was not to be expected from a well-informed body of operatives, when, from a far inferior number to that at present in the town, and without any of those advantages to be derived from these institutions, Bolton had already to boast of an Arkwright and a Crompton, the inventors of the spinning jenny and the mule, which had rendered the steam engine (to the great improver of which Dr. Black had alluded as an instance of the immense advantages science enabled her sons to confer upon mankind,) of far greater value to this country?

A list of donations and subscriptions was then read, in which the Chairman stood first for 10 guineas donation, and 1 guinea per annum. Mr. B. Hick, of the well-known firm of Rothwell, Hick, & Rothwell, celebrated for the extent and skill to which they manufacture steam engines and other machinery, a similar donation and subscription. Dr. Black, 3 guineas donation, and 1 guinea annual subscription. Mr. W. Simpson, 5 guineas donation, and 2 guineas annual subscription, with several other gentlemen: and it is expected this list will be greatly lengthened by the activity and influence of those who already appear upon it.

I am, yours, &c.

J. O.

Bolton, June 10th, 1825.

PREPARATION OF A SOLID VARNISH FOR PRESERVING IRON FROM RUST.

Oxidation is one of the greatest inconveniences to which certain metals are liable. Wrought iron, for instance, corrodes in a short time when exposed to damp or to acid vapours, and a subititute has therefore been sought for it, for various purposes, in cast iron, which is not so easily oxidated, but which has not the ductility of the other. Expedients, more or less efficacious, have been proposed for preserving iron from rust. It is generally covered with a varnish capable of withstanding the influence of the atmosphere. In order that this varnish may fulfil the conditions required, it ought to be so elastic as not to scale off, and so adhesive as not to leave any spot uncovered.

In France a patent for fifteen years was granted on the 26th of September 1791, to Madame Leroi de Jaucourt, for a metallic varnish for preserving metals from rust. It is composed of five pounds of tin, eight ounces of zinc, eight ounces of bismuth, eight ounces of copper, and eight ounces of saltpetre. These metals mix in such a manner that the metal resulting from them is hard, white, and sonorous. The small proportion of copper introduced into the composition produces no verdigris.

The articles to be covered with this coating are to be heated only in the matter itself, melted in pans of plate iron. When sufficiently heated they are taken out, and sal ammonia is strewed over them: covered with this salt, they are quickly plunged into the composition; they are then wiped with tow or cotton, as is done in common tinning, and the part coated is immediately dipped in water.

Iron nails and pins were formerly used to fasten the sheets of copper upon the bottom of ships; but since it has been ascertained that the galvanic action produced by the union of those two metals is a cause of destruction, copper nails and pins, which, though not so strong, are not attended with the same inconveniences, have been employed in their stead. A method has, however, been devised for covering iron nails with a varnish so adhesive that they may be used without danger for lining ships. Cast iron nails were proposed for the same purpose, but soon given up, because they were found very liable to break if care be not taken to strike them exactly in a perpendicular direction.

A method equally simple and advantageous for preserving iron from rust is to heat the metal red hot, and to rub it in that state with wax. After it is grown cold, you remark that all the pores of the iron are completely filled, and that this kind of coating is extremely uniform; but as it is applicable only to articles of small dimensions, it still remained a desideratum to discover a varnish which might be used cold, and which would resist the combined action of the air and of acid vapours.

M. Lampadius, professor of chemistry at Freyberg in Saxony, seems to have resolved this interesting problem. Having remarked that the sulphurous and acid vapours which rise from the furnaces for grilling ores, destroy in a short time the ordinary varnishes, and attack metals used in the construction of buildings, he studied to discover a coating which would preserve them from rust.

As it was necessary to oppose to the acids a matter which they could not dissolve, he tried two metallic oxids, already saturated with acids, and which, by their desiccative quality, are well adapted for the composition of varnish. Success crowned his attempts, and an experience of six years has sufficiently demonstrated the utility of this menstruum.

M. Lampadius employed for this purpose sulphated lead and sulphated zinc, or vitriol of zinc. The former is prepared by mixing a solution of four ounces of acitate of lead in twelve ounces of water, with a solution of seven ounces of sulphate of soda in fourteen ounces of water. The precipitate obtained by this mixture is sulphated lead, which is filtered, edulcorated, and dried.

Sulphated zinc is sold by all chemists and druggists by the name of white vitriol of zinc.

The method of preparing the varnish is as follows:—Reduce to an impalpable powder one ounce of plumbago, or anthracite, with which mix four ounces of sulphated lead, with one ounce of sulphated zinc, and add to it, by degrees, one pound of varnish, prepared with linseed oil, previously heated to ebullition. This varnish dries quickly, and perfectly preserves from oxidation the metals upon which it is laid. It has been employed with success to cover lightning-conductors, and answers equally well for roofs covered with lead, iron, copper, or zinc, which are continually exposed to the action of damp and of acid vapours.

WHITE COPPER.

M. Frick, a German chemist, has formed several alloys in imitation of white copper, or the Pakfong of the Chinese.

A mixture in the following proportions,

Copper,	47.15
Nickel,	32.25
Zinc,	26.00

composed of greyish alloy, a very little malleable when cold, not at all when heated, and flattening with difficulty. Another alloy, according to this formula,

Copper,	50.00
Zinc,	31.25
Nickel,	18.75,

produced a white metal, susceptible

of a beautiful polish, easily flattened, malleable when cold, unalterable by the atmosphere, and sonorous like silver. A third alloy formed as follows,

Copper,	53.39
Zinc,	29.13
Nickel,	17.48

approached still nearer to silver in colour and sound; it was harder than that of metal, very tenacious, but also exceedingly ductile. Its specific gravity at 15° 4′ of Reaumur was 8.556.

MODE OF PREVENTING ACCIDENTS FROM MACHINERY.

Gentlemen,—Having frequently observed in the public papers accidents happening in cotton mills by the work people getting entangled in the machinery, and being dreadfully lacerated, I am of opinion that, in many cases, the lives of those so unfortunate might be saved if the following plan were adopted.

The first thing done by the workmen when they observe a person entangled, is to run to the slack pulley connected with that piece of machinery and get the belt shifted, thereby stopping that part of the work. But this is not done without some time and a little difficulty; besides, there is not always a slack pulley to run to. The next thing that is done, in that case, is to run down three or four pair of stairs, and desire the person who has the charge of the engine to stop it, and before he does this, he must inquire the reason, and, by the time he is satisfied, it makes little matter whether it is stopped or not.

Let a bell be placed in the engine-house, and in every flat of the mill let a sufficient number of bell-ropes be conveniently placed, and these never rung except when an accident happens. The engine may then be stopped in time to save the life of the person, as the engine-man, knowing the signal, will, without inquiry or hesitation, stop the engine immediately. If this plan was put in execution, I am certain that in nine cases out of ten the result would be beneficial.

I am, yours, &c.

Thos. Laurie, Jun.

Kingston, Sept. 21st, 1825.

I may, at a future period, trouble you with a description of a machine to supersede the use of the windlas, where the power of wheel and pinion is connected with the lever, the lever being the only power used in merchant ships at present.

T. L.

MISCELLANIES.

Rapid Distillation.—Professor Oerstedt has pointed out a method of considerable utility in the evaporation of liquids. He fastens together a great number of fine metallic rods or wires, and puts them in the bottom of the still or evaporating vessel, and by this means he distils seven measures of brandy with the same fuel, which without the rods would distil only four.

A new method for ventilating and airing Vessels.—The dangerous diseases, which very often afflict the crews of vessels particularly on long voyages, is generally attributed to the imperfect circulation of the air in the hold, and also in the smaller parts of the vessels.

Several plans have been proposed for this purpose, but the most successful is said to be the ventilator invented by Dr. Waeltig. It consists of an iron furnace, into which is placed a hollow copper globe, with two aspirating pipes, and an evacuation tube. As soon as the fire is lit in the furnace, the evacuation tube begins to draw, and the draught increases as the globe becomes heated, so that when it is red hot the draught is very great.

If the fire in this furnace is burning for an hour or two about once or twice a day, it will exhaust the atmosphere of the hold to the extent of about 3 or 400 toises, and the pure air will of course flow in to supply its place.

Pectic or coagulating acid.—This new acid has been discovered by M. H. Braconnot, and receives its name from ϖεκτις, coagulum, in consequence of its resembling a jelly or gum. It is found in all vegetables. It is sensibly acid. It reddens tarnsole papers. It is scarcely soluble in cold water, but more so in hot water, and is coagulated into a transparent and colourless jelly by alcohol, by all the metallic solutions, by lime-water, water of barytes, the acids, muriate and sulphate of soda, and nitre. It forms with potash a very soluble salt, which has the remarkable property of communicating to large masses of sugar and water the effect of gelatinising which renders it of great use to the confectioner. M. Braconnot in this way prepared aromatised jellies, perfectly transparent and colourless, and very agreeable to the taste and eye. He also made with rose water, coloured with a little Achineal, rose jelly of exquisite taste.—*Annals de Chimie.*

American Steam Boat.—The Trenton is constructed upon an entirely new mode. Her boilers rest upon the guards projecting over the water from each side of the boat. This leaves the deck entirely unobstructed, and forms what may be called a promenade deck. The space usually occupied by the boilers is converted into convenient and handsome dressing rooms. Should any accident happen to the boilers, the water would be thrown directly into the river and not in the least endanger the passengers. And what is more important, the annoying degree of heat in the dining cabins is not felt. She was built at Hoboken, and it may be fearlessly asserted, the improvements in the arrangement and disposition of her machinery, are far greater than any that have been yet made since the first introduction of these boats into our waters.—*Philadelphia Freeman's Journal.*

Extracts from Bark.—That which is designed for the use of tanners is found to be most highly improved by adding to every hundred weight of the ground bark, eight pounds of the red berry which grows upon summack; the advantages therefrom are hardly conceivable, as in the first place it opens the nature of the bark and causes a much quicker precipitation of the light woody matter, when settling for evaporation. It also holds in a complete dissolved state every particle of resinous matter contained therein, and supplies the great loss of vegetable acid, so necessary in tanning, and which evidently escapes during the evaporation. The good effects of this addition in regard to tanning, is quickly to be observed from its immediate action on the leather to which it imparts a fine colour, and files in the completest manner.

Naptha Lamps or Lights.—Mr. Joseph Hecker, director of the saltworks, and administrator of the mines at Iruskawetz, in Gallicia, has found that naptha burns much better than oils or other substances in mines containing bad air, and injures the health of the workmen less. In the mines containing bad air, colza oil and tallow lights will be extinguished, when naptha, petroleum, and oil of bones will still burn. Generally tallow, or colza oil lights extinguish in air containing not more than 18.1 per cent. of oxygen; whilst naptha or oil of bone lights will burn when it contains no more than 13.8 per cent. M. Hecker found that the men were not incommoded when the oxygen in the air of the mines had diminished to 18.33 per cent. The proportion in good air is twenty-one per cent. The ventilation of these mines must be ill conducted.

NOTICES TO CORRESPONDENTS

Must be deferred till next week.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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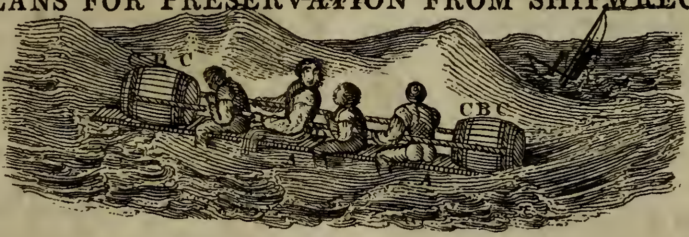
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

> "Then, oh! protect the hardy tar,
> Be mindful of his merit;
> And should pure justice urge the war,
> He'll show his daring spirit!"

No. XCIV. *Saturday*, 8*th October*, 1825. Price 3*d*.

PLANS FOR PRESERVATION FROM SHIPWRECK.



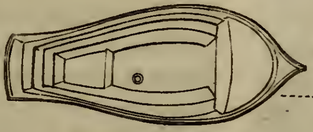


Fig. 5.

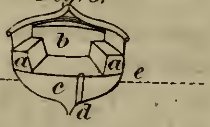
Fig. 6.


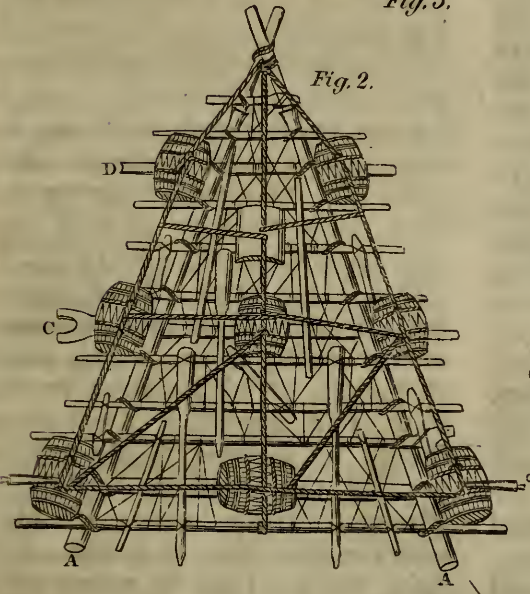
Fig. 2.


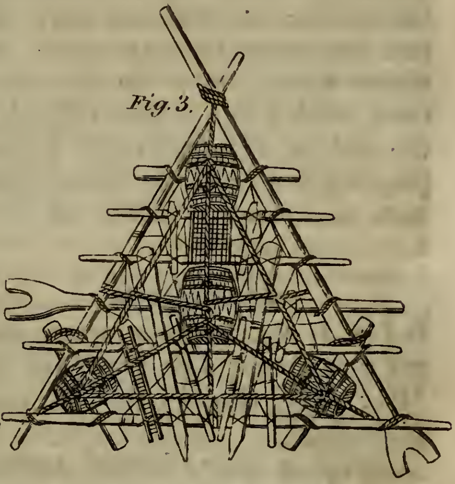
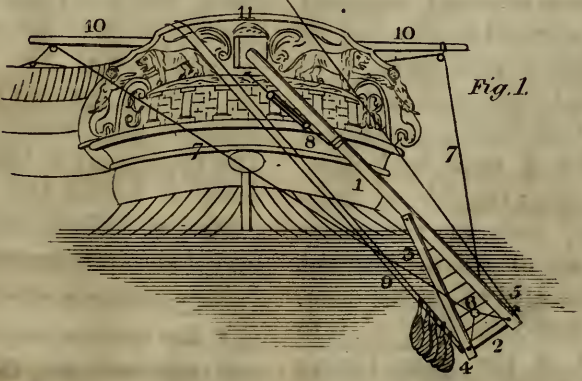
Fig. 3.


Fig. 1.


— Swan Sc —

SUGGESTIONS FOR PRESERVATION FROM SHIPWRECK.

[The following articles on the subject of preservation from shipwreck appeared originally in the Liverpool Mercury, Kaleidoscope, &c.; since then they, along with several others, were re-printed in the form of a pamphlet, by the able editor of the Mercury, at the desire of the Liverpool Humane Marine Society. As we consider many of the suggestions of great importance, we conceive it highly necessary to extend the knowledge of them as far as possible; and have, therefore, given them a place in our miscellany.]

Captain Purnell's Temporary Rudder.

In the event of losing a rudder at sea, and drifting towards the shore, it would be invaluable to know how to fit a temporary one in a few hours, in any weather, and which would steer the ship with ease; such a one is here offered to the notice of all who may possess property in shipping. Every seaman must see the utility of it on first examination.

Description.

No. 1, (fig. 1,) is a spare spar, say a top-mast, lower-yard, or any other spar adapted for a main piece.

No. 2, a piece of wood, secured to the heel of the main piece.

No. 3, a piece of wood, one end of which is secured to the end of No. 2, the other end secured to the main piece; proceed to board up one side, then turn it over; load the corner No. 4 with lead, shot, iron, or any thing capable of sinking it, taking care at the same time to fix it so as to prevent shifting; then board all up securely.

Drive an *eye-bolt*, No. 5, into the lower end of the main piece; to this bolt splice a rope for a topping lift, long enough to lead up to the mizen-topmast head and half way down again, to which fix a tackle.

Drive four eye-bolts,* one on each side of the lower end of the main piece, and one on each side of the corner, No. 4. To these bolts fix a span of rope, No. 6, on each side, with an eye in the middle of each; to these eyes splice two ropes, No. 7, long enough to lead up on each quarter through a block on the quarter rail to the wheel, and take them round as common wheel ropes.

No. 8. is a stay, to keep the head of the main piece in the step, No. 11.

No. 9, a rope leading from No. 4 to the ship's stern, down which you may send weights as occasion may require. I would advise a line to be fastened to them, in order to haul them up occasionally.

No. 10, an outrigger across the stern, with a block at each extremity, through which reave No. 7.

No. 11, a piece of oak plank, hollowed out to receive the head of the main piece, which head should be rounded similar to the heel of a derrick. This piece should be secured to the upper part of the stern in mid-ships. Having all ready, lower the rudder over the side, pass it a-stern, and hoist the head up by means of a tackle on the mizen boom: fix it into the step, No. 11; set up No. 8, with a lanyard; reave the topping-lift and wheel ropes, and, if the lower part is heavy enough to keep it below the surface of the water, it will require nothing more; but if it is not heavy enough, send weights down No. 9. Steer the ship by the wheel.

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* The eye-bolts may be dispensed with, and ropes made to answer their purpose.

If at any time it should get out of order, it may be got on board, repaired, and got overboard without much difficulty.

In tacking ship, I would advise having two men stationed at the topping-lift, and, as soon as the ship's way is stopped, top it up out of the water until she gathers head-way, then lower it down again.

Mr. Evans's Raft for preserving Shipwrecked Persons.

Sir, — Having witnessed the melancholy catastrophe that occurred on the loss of the Alert packet, off this bay, in March, 1823, when it was supposed that about one hundred and fifty persons perished, on as calm a day and smooth water as ever was seen, I was strongly impressed with the idea that some useful plan might be digested and made known to ship-masters and their crews, to guide their proceedings under such circumstances, and prevent the terror and confusion consequent on such unfortunate occasions.

With this view I made an experiment in this harbour, by constructing three different sorts of rafts, limiting the means to those materials that are already in use on board of every vessel (except steam-packets, as hereafter mentioned:) those rafts, in a very imperfect state, fully answering my expectations, a sketch of each I hereby subjoin. On fig. 2, forty men and myself crossed this harbour; and on fig. 3, thirteen men.

Raft, fig. 2, is proposed for a steam-packet, and is constructed upon a scale of spars now on board of H. M. steam-packets on this station, and intended to be put together in the following manner, *viz.*—A, A, are the masts cut down close to the deck, forty feet long; B, the squaresail-yard, forty-two feet long, first placing the latter spar, B, across the quarter rails, *upon which* the two lower ends of the masts, A, A, are to be lashed, twenty-four feet apart, with the other ends coming together and lashed across on the taffrail, which makes the triangular form and size of the raft. Near the centre, *under the masts,* lash the fore-gaft, C, twenty-four feet long, to which three butts are fastened. Near the outer end, a strong spar, D, eighteen feet long, should be also lashed *under the masts,* to which two butts are fastened; three other butts are lashed to the squaresail-yard, B. All the other spars, being the main-gaft, and those already on board, (probably two or three of particular lengths must be provided for the purpose,) are to be laid across *over the masts,* and lashed in the best manner. On those latter spars the bottom is to be made, by frapping lines in all directions, to connect the raft together, as well as to prevent any opening that a person could drop through—(if a proper netting-bottom be already prepared for the purpose, it would be of great advantage,)—over which, lengthways with the masts, every thing about the deck will come of use, *viz.* boat spars, oars, handspikes, hatches, &c. &c. In proposing this sort of raft, eight butts (or more if convenient) should be always ready slinged on deck, with proper bungs to them, four each side the deck forward of the paddle-box, could not cause much inconvenience on board of a steam-packet; added to which, it will readily appear useful to attach every thing floaty, as cork fenders, buoys, &c.; and if cork mattresses and cushions were used, it would greatly add to the buoyancy of a raft.

Being thus prepared with the necessary materials, and the mode they should be put together, with such ample assistance of men, preserving good order and proper guidance, a complete raft might be made in half an hour, and easily launched overboard; during that time the boats can be hoisted out, and take on board females, children, &c.—the boats given in charge of the mate; and it should be expected, that no master would so disgrace himself as not to be the last person to quit the raft.

I do not presume to state it as a new thing to construct rafts with spars and casks, but I am not aware of any plan where it is proposed to use them in the same manner. Fig. 2, will float above water sixty persons, and sixty more, if required, might cling to it, until assistance arrive, which would probably not be long in the tract of a steam-packet: (to prove how little will support a person's head above water, I beg to mention that two men who sunk with the Alert, got hold of a crate of eggs, which supported them until the return of the boat from the shore;)—it affords space and buoyancy, a good bearing in the water, and will not readily capsize, particularly with the pointed end to the sea. The butts are down to their full bearing before the bottom of the raft is in the water. The life lines are bent to a spar over the bung of the casks, and passed along in the best manner for the security of those using it, that while a person has any strength remaining, he has the means of holding fast to prevent being washed off. Also in approaching a lee-shore and shoal water, a raft of this description would be preferable to a boat, as the former would probably get within the reach of assistance, but in many instances boats, when near the ground, have swamped, and all on board perished.

Fig. 3, is a copy of a raft made with the materials found on the quarter-deck of a brig of about 200 tons, and constructed with boom, gaft, studdingsail-booms, &c., with four butts, and put together as already described.

As connected with this subject, I also mention, that I have always had the S. Stack gig-boat fitted out with small kegs for water ballast. Two ring-bolts, one forward and the other aft, are fastened to the keel with a good rope span extended from one bolt to the other. The casks being well slung and bunged, are secured below to the span at the bottom, and above to the thwarts; there are also two boat pumps, with which the kegs are emptied in a few minutes, and the boat becomes a complete life-boat. The experiment was made years ago, and lately in this harbour, when the boat full of water proved sufficiently buoyant with four men and myself. In cases of great emergency, when boats have to pass through high cross seas, this method might be found useful and simple.

In submitting these suggestions, I can only propose them as the outlines of what may be done, and leaving it to every experienced mariner to improve and adopt his own plans; at the same time I reckon every thing of this description in some measure useful, as tending to prepare and lead the minds of seamen, when in distress, to make use of the means within their reach.

H. W. EVANS,
Agent to the Trinity House,
and Harbour-master.

Holyhead, July, 1824.

Lieutenant Rodger's Raft.

A, (fig. 4,) is an oak plank nine or ten feet long, two or three inches thick, and six or eight inches broad. If a deal plank, it would be adviseable to bind some iron or lead with cordage to the *bottom* of the plank, near the ends, or bags of silver or gold, or any other valuable heavy articles, which would act as ballast, and keep the men upright, say 40 or 50 pounds weight each barrel; but long bags made with sail cloth, and filled with sand or coals, would be less liable to shift, or get loose. B, B, are two empty barrels or water-casks, such as would contain 36 gallons each; if larger the better. Two wine pipes or butts, would do well on 12 or 14 feet planks, and would carry all the men that could sit on it; these barrels, pipes, or butts, should not have any article put into them that is heavy, but only very light articles, as paper, &c. for the more buoyant the casks are, so much the better. These barrels must be water-proof, closely bunged up. C, C, C, C, is a small rope, bound two or three times round on each side the bulge of the casks; and four small notches should be cut on each side of the plank, to prevent the casks shifting off the plank. D, D, is a rope made fast from C, C, to C, C, on each side, to prevent the men from being washed off the plank, fixed under their arms, so as to leave sufficient room for them to row with their hands. E, E, E, E, men siting on the plank between the ropes. If the casks are large, the ropes D should be drawn closer, with small cordage, close to the end of the casks, and one in the middle, so as to have just room for the men to sit between the ropes D, and row with their hands.

A barrel containing 36 gallons, will carry 300 pounds weight without sinking. Forty or fifty pounds will keep any man's head above water; there is no fear of overloading. I consider that water casks, ropes, and planks, are articles that very few ships sail without, and having the means in their own power, the mariners are more likely to escape; and as shipwrecks more frequently happen in the night, and at a distance from any large town, assistance from land must be very uncertain.

The only objection the inventor ever heard to this plan is, that the sailors would be likely to leave the ship too soon; but this is not probable, for they would not readily leave the ship, if there were any chance of saving her; besides, it would be safer for the men to sit on the planks till the ship goes down.

R. C.

Bixley, near Norwich.

Iron Life-Boat.

Fig. 5. View of the iron life-boat, from above.

Fig. 6. Section of the same.

a and *b*. Cavities under the seats and at the stem of the vessel.

c. Cavity between the floor and bottom.

d. The well.

e. Water line of the boat.

It is evident, that if the well be left entirely open, the water cannot rise up it higher than the level of its surface without; and any water that may be taken in, over the sides, will sink down the well until it finds its proper level.

Sir,—Accounts of shipwrecks, and abandonments at sea, have come before us very frequently of late. The suffering, and loss of life, occasioned by such misfortunes, must be lamented by all; and will, no doubt, insure a favourable reception to every attempt that may be made to remedy the evil. The most obvious method that presents itself to the mind, of accomplishing this desirable object, is that of providing a life-boat for every vessel that goes to sea. The neglect of this practice must have arisen from the general unfitness of such boats for common use. To remove this obstacle, I have constructed a life-boat of a different description, which I beg leave to submit to the judgment of the public. I believe it will be found to possess all the essential properties of a life-boat, and to be capable, at the same time, of answering the common purposes of a ship's boat. Should the adoption of this boat be the means of lessening the number of victims, who annually fall a prey to the devouring waves, and of abridging thereby the sum of human misery, I shall not consider the time I have devoted to the subject as spent in vain.

The description of the life-boat which I recommend, is as follows: It is made of wrought-iron plates, and furnished with a number of air-tight cavities, the buoyancy of which renders it impossible that it should sink. The plates are rivetted together, somewhat in the manner of steam-engine boilers, but so as to present no obstruction to the passage of the boat through the water. Some of the cavities are formed in the spaces underneath the seats, and two others are formed at the stem and at the stern of the boat. The principal use of these particular cavities is to prevent the boat upsetting, which they will do, even should the gunnel or side of the boat be forced considerably under water. Another and much larger buoyant space is formed between the bottom of the boat, and the false bottom or floor on which the feet of the passengers rest; this floor is fixed a little higher than the level of the water, even when the boat is "set down" with a moderate load. A pipe or well is made to pass directly down through both bottoms, and through the cavity between them, so as to allow the water a free passage without admitting it into the cavity. The effect of this construction is, that, besides the buoyancy acquired, the boat will discharge itself of any quantity of water it may happen to ship in a rough sea. Should the boat be loaded deeper than the level of the floor, the water is prevented from rising into the interior of the boat by means of a valve.

In order to show the practicability of the plan, I have built a boat which nearly answers to the above description. It is 17 feet 8 inches long, 6 feet wide, 3 feet deep, draws 14 inches water, and weighs 18 hundred, 2 quarters, and 20 pounds. The experienced seaman, on inspection of this boat, will, no doubt, be able to discover many defects in its shape; but I beg him not to let this circumstance prejudice his mind against iron life-boats in general. The one to which I refer was built in a great measure from written descriptions, and by a workman who never resided in a seaport town. Objections of this nature may, therefore, be expected; but will be easily obviated in any future attempt. To meet those that may be advanced by interested persons against the material of which my life-boat is made, I request a candid consideration of the following reasons in favour of the use of iron, in the construction of boats of every description :—

1. Strength and tightness. With iron, a boat can be built of any strength that may be required. The tenacity of the material is so great, and the joints that can be made with it are so perfect, that boilers of considerable magnitude are in daily use, bearing a pressure

of steam within, equal to 100 pounds upon every square inch of their surface; and they are commonly first proved with a pressure of 400 pounds to the square inch.* If an iron boiler can be made to resist this enormous internal pressure, we may confidently conclude, that an iron boat, constructed in a similar way, will be adequate to sustain any external force which it is likely to encounter from the buffeting of the waves.

2. Durability. The considerations under the last head apply with equal force to this; but to these I would add, that an iron boat is not subject to injury from the effects of the sun; nor from the still more injurious attacks of the worms in southern latitudes. The oxidation of the iron, which will appear to some to detract much from its durability, will be found of very little moment in practice.

3. Rate of sailing. The smooth surface of iron, and its very great elasticity, must lead to the conclusion, that a vessel, built of this material, will sail faster than one of the same size and shape built of wood.

4. Capacity for burthen. It is found to hold universally, with respect to canal boats, that those made of iron (of which there are numbers constantly in use) will carry a larger cargo than wooden boats of the same size. The result must be the same, however you may modify the shape of the boat, or in whatever mode of navigation it may be employed.

5. Cost. It will be expected that I should say something of the comparative cost of the common, and the proposed boats. This I can only speak of at present on conjecture; I think I may, however, safely state, that iron boats, with the safety apparatus included, will not exceed the cost of wooden ones, more than about 50 per cent. Even at this rate, and considering them only in the light of common boats, they will be the cheapest in the long run. But as the facility of making them will increase by practice, and by the invention of machinery, I should not be surprised to see them sold much lower than wooden ones, before the lapse of many years.

Any gentleman desirous of trying my boat, may put it to what proof he thinks proper, on application to Mr. Parry, boatman, who has the care of it at the George's Dock ferry-basin. A model on a small scale, which will show more clearly the principle on which it acts, I beg permission to lodge for inspection at the office of the *Mercury* newspaper. And any further information on the subject that is desired, I shall be happy to communicate as far as lies in my power.

I am, yours, &c.
Thos. Jevons.

Liverpool, September, 1822.

Expeditious Mode of converting a Common Boat into a Life-Boat.

Life-Boats are not always at hand; there is sometimes difficulty in launching them, and it is frequently impossible to reach the vessels which require their assistance. When we reflect upon the frequent swamping of common boats, from having too many persons on board, in endeavouring to escape from wreck, the great utility of this simple contrivance will be manifest to all, but especially to those for whose use we have made this extract, from several of the latest Philosophical Journals, published in London. The idea was suggested and put into practice by the Rev. James Brenner, Minister of Walls and Flota, Orkney Islands.

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* The bursting point of high-pressure boilers is from one thousand to one thousand two hundred pounds upon the square inch.

Having a great many years ago witnessed a melancholy scene of shipwreck, and seen men perishing at little more than the distance of 100 yards from the shore, it forcibly struck me, that though there was no possibility of getting from the shore to them, yet there was a great probability that means might be found, by which those in such situations might with safety be enabled to effect their escape to the shore; and farther considering, that the very precarious aid of some accidental piece of wreck (under every disadvantage and in a tempestuous sea) sometimes serves to save life, I was confirmed in the opinion, that some method might be devised, which, upon good grounds, would hold forth the promising propect of safety in all the common and general cases of shipwreck. Hence it was that to devise such a scheme became the object of my research ever after.

The following plans (especially the first) are so simple, and the effect so obvious, that I cannot allow myself to think that any seaman can entertain the smallest doubt, but that a boat so prepared would live in any sea whatever, could neither sink nor overset, and could carry in safety a number of people, in proportion to her size, over a bar, or from the wreck to the shore through any surf.

The plan may be executed upon boats of all dimensions, and the largest, provided they could be got out, would be found the most advantageous; but all circumstances considered, the size deemed in general best adapted for the purpose would be any boat from 16 to 20 feet in length, which is to be prepared as follows:

Two additional ring-bolts are to be fixed in the keel within-side of the boat. One to be placed one-third of the boat's length from the stem; the other one-third from the stern. Two augur holes are to be put through the keel without-side, and close to the garboard stroke. One of these holes to be put about half-way betwixt the ring in the stem, and that next to it in the keel; the other about half-way betwixt the ring in the stern, and that next to it in the keel. Plugs may in ordinary be put into these holes, to be struck out when occasion requires.

Those ring-bolts, which are in ordinary in every ship's boat, the two additional ring-bolts in the keel, and the two augur holes, are all intended as secure points of fixture, to which seizing-ropes are afterwards to be attached.

In the next place, two tight empty casks are to be provided, of such dimensions that their length may be fitted to the width of the boat, when laid athwart-ship, and their diameters to be about three feet, and if larger so much the better.

Each cask must be furnished with a sling on each end, and each sling to have two eyes on it, about six inches asunder, and the slings so put on the cask as that the eyes may be on the upper side when laid into the boat, that the seizing-rope may pass through those eyes in their way from ring-bolt to ring-bolt.

One of these casks, so prepared, is to be laid in forward, and the other aft; and each cask so near its respective ring in the keel, as only to leave sufficient room for passing the seizing-rope through the ring in the keel.

By this means the vacant space to be then filled up with cork, will be left betwixt the cask and the bow forward, and betwixt the other cask and the stern aft.

The requisite quantity of cork, according to the dimensions of the boat, and the quality of the cork, may be about a hundred and a half or two hundred weight, for each end of the boat, and that for each end ought to be made up into two separate bundles, each bundle being fitted to the width of the boat, and the uppermost one forming an arch from gunwale to gunwale.

The cork is to be made up in canvass, done over with soft pitch for preservation, and each bundle marked and numbered according to its place.

The casks and cork being laid into the boat, seizing-ropes are then to be applied for securing them in their places.

Here it is to be observed, that the single turn of rope which is to go through the augur hole in the keel and round all, should be the first made fast, that the other seizing-rope (which we shall suppose to have been made fast to the ring in the stern) may, in passing through the eyes on the sling, take in the surrounding-rope betwixt the two eyes, which will probably prevent the surrounding-rope from slipping to either side of the cask.

The seizing-rope having passed through the eyes on the sling, is then to be passed on through the ring in the keel, and thence back again in the same manner, through the eyes on the sling on the other end of the cask, to the ring in the bow; and lastly, the seizing-rope is to be brought directly from the ring in the stern to the ring in the keel, by which it will cross the cask at the bung or middle part of it; the other cask and cork aft are to be secured in the same manner.

The preparation will be completed by attaching a bar of lead or pig-iron, of about two hundred weight, to the keel within-side, by means of the ring-bolts in the keel, or otherwise.

The following Letter, written in consequence of the loss of the Alert Packet, was addressed to Mr. Gladstone, through the medium of the Kaleidoscope.

Sir,—Having observed in the public prints, a statement of the loss of a great number of lives, about 140, by the wreck of the Alert packet, and that you had humanely stepped forward in the House of Commons and made a motion for the purpose of causing the owners of steam packets to provide a sufficient number of boats to give aid in such emergencies, I have presumed to take the liberty of addressing you, and to submit a plan for saving lives, by means of applying the principles of my life-boat to any kind of boat in common use, having the advantages of cheapness and general practical utility, instead of the tedious and expensive plan of building life-boats on purpose, wherein only partial or limited benefits can be obtained.

The plan is so simple, that any person will immediately understand the principles upon barely stating an outline. It consists, in the first place, of converting any boat into a flexible boat, by covering the outside of it with canvass, sacking, leather, or hides, nailed on so as to secure or bind the timbers together, then surrounding the gunwale with a rope, and also fastening the timbers in particular places, where requisite, by pieces of thick strong leather or rope nailed on. The above being done, a bag or collar of cork, of sufficient dimensions, is to be lashed on firmly round the gunwale; lastly, additional bags of cork are to be placed over the collar, at the ends, (the bow and the stern,) to give a curved or elliptical form, which will, besides adding buoyancy, cause the boat to right again, in case she should upset. All the above canvass, sacking, leather, &c. to be rendered waterproof by varnishing, tarring, or pitching the same. The boat to be provided with a sufficient number of ropes, attached to one side only, because, in case of upsetting, the people being all on one side, the boat may right again instantly. Having taken the liberty of submitting the above plan to your notice, you will, I trust, Sir, see many advantages in having one or more of the ship's boats provided as above, which will be the means of saving many lives.

I beg to mention, that I have proposed my plan to the gentlemen of the committee belonging to the Glamorganshire packets at Bristol, and they have given orders to have the same carried into effect forthwith.

It will, I am persuaded, afford you much pleasure to give farther extension and utility to your late suggestion. I have the honour to be, Sir, your most obedient, humble servant,

Wm. Henry Lassalle.
College Green, Bristol.

May 16th, 1823.

ON THE IMITATION OF THE GRECIAN ARTISTS IN PAINTING AND SCULPTURE.

No. III.

Although many sublime lines of beauty and graceful touches were obtained by the Grecian artists from the study of the ideal world, it must not be imagined that, by entering into this airy region, they wandered from nature and truth, for this was by no means the case. Though they made several excursions into the ideal world, yet nature was their home, and they never lost sight of it. The great rule which the Thebans prescribed to their artists, *viz.* "to imitate nature as far as possible," was carefully observed by the Grecians in general. As often as they perceived that they could not execute their fine profile without departing from truth, they followed nature in preference to idea, as may be seen in the beautiful head of Julia, the daughter of Titus.

To imitate faithfully their model, and at the same time to embellish it, and thus to unite truth and beauty, was the grand principle of the Grecian artists, and the fundamental rule they followed in their productions. But it is not evident that the observation of this rule supposes in a painter or a statuary an idea of perfection beyond what nature actually exhibits. Polygnotes is famous in the history of the arts for his constant adherence to this leading principle.

We are indeed told, that Cratina, the mistress of Praxiteles, furnished that celebrated artist with the idea or model of his Cnidian Venus; and that another famous painter used the figure of Lais as a model for the representation of one of the three Graces. But there is nothing in all this inconsistent with the general rules already mentioned. The painter or sculptor found in the model he had before his eyes, (were it a Cratina or a Lais,) particular features and lines of beauty; but he drew from his ideal model the master-strokes of elegance and expression, the beautiful arrangement and composition of these parts which he had taken from actual nature. What was human in his picture or statue, he derived from the first of these models; what was divine, proceeded from the second.

Those whom a superior taste, aided by reflection and study, has initiated into the mysteries of the fine arts, will perceive, in the productions of the Grecian artists, beauties that are very little known, and that escape the penetration of a common observer. And these beauties will appear still more striking to them when they compare the productions of the ancient with those of the modern artists, more especially of such as follow nature timorously and servilely, without invention and freedom.

In the carnations of the greatest part of the moderns, the skin is represented by a multitude of small folds that are too apparent, and are expressed with a certain degree of harshness: the Greek artists represented, on the contrary, these folds by easy and flowing curves, or waving lines, which arose out of each other by an imperceptible transition, formed a whole, and seemed to be produced by one stroke of the pencil or chissel. In these master-pieces of antiquity, the skin, instead of exhibiting an air of constraint, and appearing to be drawn by effort over the flesh, seemed, on the contrary, blended with it, followed exactly all its contours, and had none of these detached folds which make it look like a substance separate from the body it covers.

Several other circumstances might be mentioned, which distinguish the productions of the ancients from the works of the modern artists; circumstances which were probably derived from the superior beauty of the models they had to work after, as has been already observed, the glow of health and vigour that the bodily constitution of the Greeks derived from the benign influences of a purer air and a mild and temperate climate, and from the public exercises, contributing, no doubt, to furnish the painter and the statuary with the most graceful and excellent objects of imitation.

It has been from time to time asserted by certain individuals, that this admiration of the remains of Grecian antiquity ought to be looked upon as the effect of prejudice or whim; and they have imagined, or pretended to imagine, that these remains have nothing but their age to recommend them. The famous Bernini, though neither his taste nor his extensive knowledge would allow him to embrace this strange opinion in all its extent, was nevertheless far from being zealous in recommending, as a principal and essential rule, the study and imitation of the ancient artists. His notion, or rather his leading maxim was this: "That nature had given to all its productions the degrees of beauty which belonged to each, and that it was the province of art to find these beauties out, and to combine and express them with elegance and truth." He was also, as is well known, one of those who would not acknowledge the superiority of the Greeks in the imitation of select or beautiful nature, and in the expression and use of ideal beauty. He acknowledged, indeed, that the transcendant beauty of the Venus de Medicis had for a long time prejudiced him in favour of the Greeks, and made him entertain a very high notion of their superiority to all other models; but he boasts of his having triumphed over this prejudice, in consequence of long observation and study; which showed him that all the beauties of this famous statue were to be found actually existing in nature.

Let us examine a little this confession, since it is very remarkable, furnishes an argument against the famous artist that made it, and represents, in the strongest light, the excellence of the Grecian productions, and their claim to a place among the most perfect models. Bernini acknowledges that the Venus de Medicis pointed out to him beauties in nature which he had not before discovered, and which, without this guide, he would never have sought after, as this statue alone could make him imagine their real existence possible. What, then, is the conclusion deducible from this declaration? It is evidently this: That the fairest lines of beauty are much more easily to be discovered in the Grecian statues than in nature herself, and that they are less dispersed, and make a more striking and powerful impression by their re-union in these sublime copies than when they are scattered far and wide in the original. Allowing, therefore, the study of nature the highest degree of merit it so justly claims, it must nevertheless be granted that it leads to true beauty through a much more tedious, laborious, and difficult path than the study of the antique, which presents immediately to the artist's view the object of his researches, and combines, in a clear and strong point of light, the various rays of beauty that are dispersed through the wide domain of nature. When, therefore, Bernini exhorted constantly the young artists to study select or beautiful nature, he gave them undoubtedly good advice, but did not place them in the shortest road to perfection.

There are two ways of imitating nature. In the one, a single object occupies the artist, who endeavours to represent it with precision and truth; in the other, certain lines and features are taken from a variety of objects and combined and blended into one regular whole. Portraits and all kinds of copies belong to the first kind of imitation, and productions of this kind must necessarily be executed with high finishing, and little or no invention. But the second kind of imitation leads directly to the investigation and discovery of true beauty—of that beauty whose idea is *connate* with the human mind, and is only to be found there in its highest perfection. This is the kind of imitation in which the Greeks excelled, and in which men of genius excite the young artist to excel after their example, *viz.* by studying nature as they did. But these men of genius do not consider that the Greeks had, in this study, many advantages of which we are deprived. Nature carried to them a fairer and more beautiful aspect than she does to us; they had innumerable occasions to contemplate and observe her, of which we are deprived; they had models which are but rarely to be found in our days. It would be extremely difficult to find, in modern times, a human body as perfect in proportion, beauty, and grace, as the statue of Antinous. Where shall we find any thing so sublime as the more than human proportions of the Belvidere Apollo? The utmost powers of nature and art are exhibited in these marvellous productions.

CATERPILLARS.

Monsieur De Buffon, in his history of the caterpillar, seems to consider that they are invariably produced from eggs. There is a species of caterpillar which feeds upon cabbages and the leaves of gooseberry and other bushes, and is to be found in plenty in all our gardens; it is generally about the thickness of a small goose quill, and in length little more than an inch, perhaps an inch and a half; in colour black and yellow, and covered with a short, thin, and almost imperceptible dark hair or down. This insect, at the end of autumn, retires from the field, and is frequently found under the eaves of houses, or other fissures or crevices of temporary security, where, after being a few hours, instead of depositing its eggs, as would be the natural inference after consulting M. De Buffon, it brings forth its young, but in a very strange and singular manner. The natural process in other animals is here altered for a more peculiar mode, and this insect *actually exudes*, if I may so use the term, *its young from its sides!* Buffon takes notice of certain holes, or "stigmata," in the sides of the caterpillar, but these, he is fully persuaded, are the air-tubes or lungs of the insect, and in support of this opinion, he refers to an experiment tried by Malpighi, proving these "stigmata" to be the lungs of the insect, of which there are eight on each side of its body. These "stigmata," however, he states, at least some of them, are seen to open into its *intestines*. Is it not more consistent, then, that, instead of air-tubes or lungs, for such a great quantity whereof, in so small an insect, there appears no reasonable use, these "stigmata" are the proper and peculiar vessels for producing and exuding its young? In this particular insect, at least, it is so.

The insect in question, after giving birth to its young, which are in the shape of small white maggots, dies, and gradually withers, and drops off, while its young, which may be between two and three dozen in number, cluster together, and are covered or overspread with a yellow down or film which gathers over them, and in this state they remain throughout the inclemency of winter.

Curiosus.

DUNBAR MECHANICS' INSTITUTION.

Almost every week it is our pleasure to be able to notice the originating of some new Mechanics' Institution in some part of our native country: we have now to acquaint our readers that the noble exertions which have been made in the cause of general education, has excited a spirit of imitation in the town of Dunbar. On the evening of the ninth of September last, a meeting was held in that town with a view to originating a Mechanics' Institution, which was numerously attended not only by the working classes, but also by the higher and middling classes, who all seemed to take the most lively interest in the object for which they had been called together. It was therefore proposed and unanimously agreed, that a Mechanics' Institution should be organized there, and that its operations should commence early in the month of October next. An interim Committee was appointed to frame regulations for the establishment. Since this meeting, Mr. Hunter of Thurston has allowed himself to be nominated Patron and President of the Institution. We shall be very glad to receive information from Mr. Watson the Secretary, or any other of the members of the Committee, as to the progress of this excellent work.

VENICE.

THIS is the country of Titian, of Palladio, of Marcello, who from a nobleman became one of the finest musicians in Italy; of Bembo, one of the most liberal and accomplished of cardinals; of Paul Sarpi, who kept his countrymen independent of the Church of Rome.

The Venetians are like a lively family cut off from the rest of Europe. Let the reader imagine himself pushing off from a sea-coast, and coming at a distance of a league and a half upon a city standing in the sea. This is Venice. It is built upon seventy-two little islands, the houses abutting directly upon the water, the finest of them without even a landing-place but the stairs; so that instead of streets there are only canals of sea-water; and instead of coaches and carts, gondolas and other boats. Perhaps the best idea the reader can have of a Venetian street is to imagine a street like Portland Place, or rather a more winding one like the High-Street at Oxford, mixed with nobler as well as smaller houses, and the full sea running through it, with abundance of boats of traffic and swift darting gondolas. The gondola is a sort of wherry, about five feet broad, and twenty-five long, covered with black cloth, and having a cabin standing up in the middle of it like the body of a caravan. The cabin is covered with black also, and has moveable windows with curtains. A Venetian gentleman keeps his gondola as an Englishman does his coach; only with much greater cheapness. The full complement of a gondola is two rowers, who stand to their oars, one at each end, and with their faces the reverse way of our boatmen. They are very expert, and dart their gondolas in and out among the intricacies of this watery bustle like fish. They are proverbial for their cheerfulness and honesty. They used to be famous for singing passages out of Tasso and other Italian poets; but political trouble has dashed the spirits even of the Venetian gondolier, and he is now comparatively mute*. The guitar, however, is still heard in Venice, especially in the evenings; and the visitor continually hears those delightful dancing airs which have been collected and published in this country. The chief, or rather the only place of assemblage for the inhabitants of Venice out of doors (for they have a fine opera, and multitudes of opera houses within) is a large square, containing the principal church, and the government offices. Here all ranks are accustomed to meet of an evening; and here something of amusement is generally going forward all day, from the guitar-player to the punchinello. There is very little more standing-room throughout the city; and so little vegetation, that they call a court by way of eminence the Court of the Tree, and there is a church entitled Our Lady of the Garden. There is a monastery with one of these gardens, such as they are; the palace Zenobio has another, and a Casino*, called Zanne, another. We suppose they muster up some others in miniature; but there is an island near Venice, where the gentry have country-houses, and contrive to be a little more horticultural.

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* It is curious and natural enough, that one of their most favourite passages was the beginning of the seventh book of the Jerusalem Delivered, where Erminia gets among the country-people. They sang to a kind of a chant, sometimes responding to each other; and the effect at night-time, when the sound came softened by distance over the water, was often delightful. Rousseau who was once at Venice, published the chant in notes. We do not remember whether it is from him that Mr. Shield has copied it in the appendix to his Introduction to Harmony; but it is there to be found. Ariosto used to be the great favourite with the Venetians; but Tasso's poems seems to have superseded even the Orlando in popularity. An Italian gentleman, when asked his opinion of this mystery, thought it explained by the great mixture of Turkish affairs in the Jerusalem, the Venetians having had a good deal to do with the Turks, both as enemies and friends.

Next to its watery streets, Venice is remarkable for the number of its bridges and palaces. The latter are truly so called, and comprise many of the master-pieces of Palladio. Every noble family appears to have once occupied a palace, some of them many palaces. They stand upon the principal canals, into which run smaller ones, all of them having their bridges. These bridges, however, are in general very small; nor is the famous one, called the Rialto, so remarkable as its celebrity would imply, though it is built in a striking manner, of one arch. It has houses on it, like old London bridge, though not after the same fashion. They cross it in a covered angle, forming a double arcade. The artist who built it was called Antonio of the Bridge. In the same spirit of poetical tendency, the bridge leading to the city jail is called the Bridge of Sighs; and one of the principal canals, probably from the residence of some great musician, is entitled the River of Song.

The Venetians have always been famous for their enjoying temper, and what the Italians call Brio—a certain sparkling of the animal spirits. A quintessence of this quality would seem to have been almost the only thing which made a late celebrated dramatist, Goldoni, be taken all over Europe for a great genius. Yet the Venetian character in general is relieved from the frivolous by an evident capacity for the serious. The wine in their blood has a body with it. There is a tone and substance in their composition as different from the old French levity, as Titian's pictures are from La Guerre. You still meet with Titian's men and women at Venice,—the same rich dark complexions and fine figures; the same faces, earnest without sharpness, quick without confusion, thoughtful without severity, voluptuous without grossness. The men are robust as well as agile: the women have that sort of tone in their composition which made the very courtezan of Venice a Calypso to strangers, and enthroned the more sentimental mistress at the top of her sex, at once to fascinate and to rule.

The leading men in the state, the counsellors at law, &c. take advantage of this solid part of the national character to affect a prodigious air of gravity: and it was perhaps from a mixed spirit of republican pride, and a sort of gusto of contrast to the pleasurability of their temperament, that black colours became the national wear. Not only the divines and lawyers wore black, but the statesmen wore black, the ladies all wore black; and the gondolas, carrying guitars and lovers in their bosoms, were clothed in the same external symbol of solemnity. We believe it is the same to this day, if not so universally. There seems in this a kind of pleasant and avowed hypocrisy, which stands the lively and sincere Venetian instead of the more hypocritical zests of other countries.

Venice originated with fugitives from the Italian peninsula during the fierce time of Attila, and subsisted afterwards as an independent state for many centuries, unbesieged even but by the waves. Its famous oligarchical form of government, under which it became mistress of the sea, still divides the opinions of politicians. Some think it must have been an intolerable tyranny; while others, among whom is our republican countryman Harrington, have regarded it as the true model of a popular state. The truth seems to be, that the good climate and cheerful temperament enjoyed by the Venetians rendered them very easy subjects; and this easiness had its effect in turn upon their leaders, who, with all their outward stateliness, were in reality like themselves. There was none of the physical suffering, which naturally renders the people so impatient in harder climates; and on the other hand, the rulers were generally wise and kind, and not provoked into tyranny either by conscious injustice, or extra-national ambition. The Venetians were too contented with what was done and allowed, to quarrel for the last sad privilege of political talking; and provided a Venetian did not talk politics, he might talk or do any thing he pleased. Thus they were like a happy family living under a father of austere aspect and real good-nature. But as their less happy neighbours out-grew them, this happy family was to be disturbed; and it was so. Venice, in common with the other northern states of Italy, became the property of the greatest neighbour for the time being—of the Court of Vienna first, then of France, and now of Vienna again. Its nobles are at length ruined; its palaces almost deserted; and the gay Venetian, now a pensive animal to what he was, meditates on the approaching period when his very city is to be forsaken by the sea; when Venice itself, eyeless, voiceless, and dead, is to stand like a gigantic skeleton on a stagnant and deserted shore, whistling with the screams of sea fowl, and the disdainful rushing of the wind.

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* Baretti defines one of these Casinos exactly. He calls it "a small house kept for pleasure in a town, besides our own." They are in great request at Venice; more so now, we suppose, than ever, since the nobility have shrunk in their palaces like withered nuts.

This apprehension now appears to be a good deal entertained. It was entertained also nearly forty years back, perhaps long before; and was understood to be disproved at that time. According to the systems, however, and calculations of modern philosophy, the sea-coasts all over the globe are in a constant state either of an accession or diminution of waters; and the imagination, in its gloomier moments, may still contemplate the dissolution of Venice, approaching or far off.

Still the Venetians, compared with most other people, are a happy race. The blood runs quicker in their veins. They have more music, more freshness and easiness of life, more cordiality of intercourse. The good-natured philosopher still finds in Venice the greatest mixture of liveliness and sentiment: the restless man of genius, impatient of the contradiction of his young hopes, still finds there something to admire and to love. If the Venetians have been thought of too amorous a disposition, they are acknowledged to be temperate in every other respect, and to make excellent parents and kinsfolk: and it is to be observed that in many of the cities of Italy, the proneness to love has gradually produced a state of opinion on those matters, less severe than in some other countries; so that they do not violate their consciences as much as might be supposed, and the guilt is of necessity diminished with the sense of it. A late traveller says, that the most striking thing after all in Venice is the extreme kindness and attentiveness of all ranks of people to one another. A young man going by with a burden, begs his "good father" (any given old gentleman) to let him have way; and the good father in as unaffected a tone is happy to make way for his "son." It may be answered, considering the Venetian character, that this is but natural; and that the old gentleman did not know whom he may be talking to. But these, we conceive, are evidences which the disputatious moralist would do better in letting alone.

The Indicator.

MISCELLANIES.

Electrical Gale.—On the 6th December, 1823, about 100 miles to the west of the Fiord of Drontheim, the Griper, commanded by Captain Clavering, experienced a severe gale which lasted three days, and during which period there was no intermission of its violence. This gale was remarkable for the small amount of the effect produced on the barometer, either on its approach, during its continuance, or on its cessation; and by the indications which were afforded of its having *originated in a disturbed state of electricity in the atmosphere.* It was accompanied by very vivid lightning, which is particularly unusual in high latitudes in winter, and by the frequent appearance, and continuance for several minutes at a time, of balls of fire at the yard-arms and mast-heads. Of these, not less than *eight* were counted at one time.—*Sabine's Pendulum Experiments.* p. 181.

Communications from intelligent Mechanics will be very acceptable, in whatever style they may be written, if they contain a full account of the invention or improvement, which is the subject of their notice.

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MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

> "Truth shall restore the light by Nature given,
> And, like Prometheus, bring the fire from Heaven."

No. XCV. *Saturday,* 15*th October,* 1825. Price 3*d.*

LENORMAND'S NEW CHRONOMETER, GRIEBEL'S NIGHT CLOCK, &c.

Fig. 1.

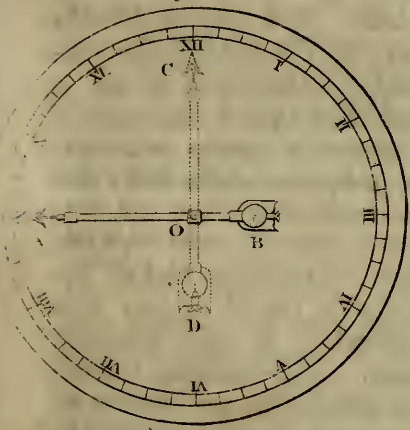


Fig. 2.

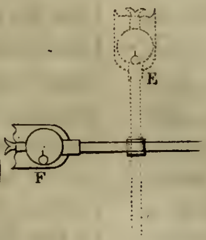


Fig. 3.

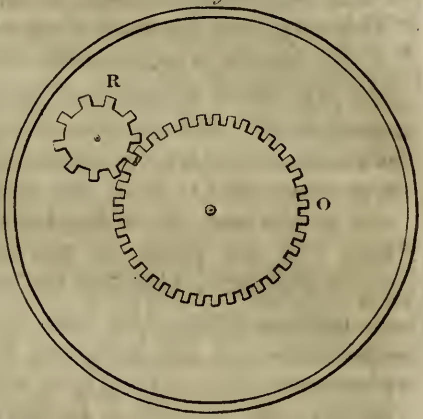


Fig. 4.

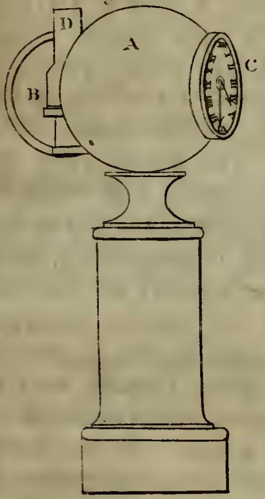


Fig. 5.

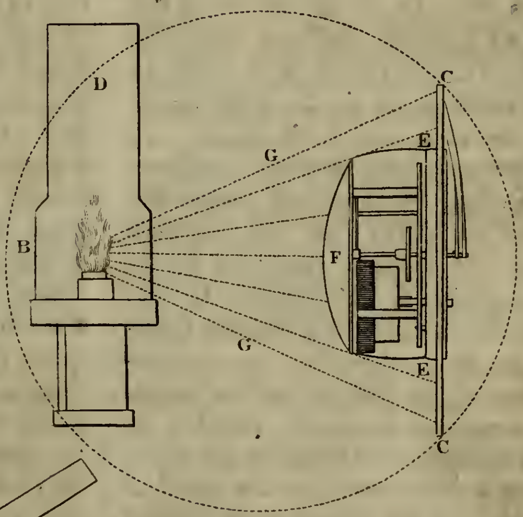


Fig. 6.

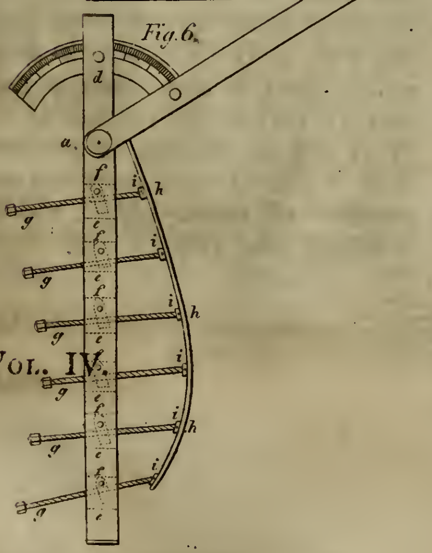
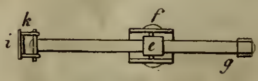


Fig. 7.



Swan Sc

DESCRIPTION OF LENORMAND'S NEW CHRONOMETER.

This very singular piece of mechanism, which excited much interest at the expositions of French industry in 1819 and 1823, is represented in figs. 1, 2, 3. The principle of this chronometer consists in the continual displacement of the centre of gravity of the arm of a lever. This lever has the form of an arrow, A B, fig. 1, which is capable of moving round a horizontal axis, O, fixed in the middle of a dial-plate divided into twelve hours. The two arms, A O, B O, are unequal, and at the end, B, is fixed a round box. If we place in the box a small weight, which has the power of moving round the interior circumference of the box, and if it is placed as at B, the arrow will remain in the position A B, and point to IX^{h}. If the small weight is placed as at D, so as to be at the greatest possible distance from the centre, O, the arrow will point to XII^{h}, and so on at the other quarters, as at E and F in fig. 2. In like manner, intermediate positions of the little weight will cause the arrow to point to intermediate hours. If we now could fix in the box a piece of wheel-work to displace this weight in a regular manner, so as to describe the circumference of the box in twelve hours, the arrow, A B, would revolve in twelve hours, and would point them out on a dial-plate like the hand of a clock. If the wheel-work should carry the weight round the box in an hour, the arrow would mark minutes on the dial. The additional weight which we have used for the purpose of explaining the principle of the machine, is not actually used. It exists naturally in every watch, as the centre of gravity of every watch is at a distance from its centre of form, on account of the weight of the main-spring, box, and fusee. We require, therefore, only to place a watch in the box, B, fig. 1, in such a manner that it cannot go without communicating its motion to the arrow, A B. This may be done in two ways: 1, The axle of the central wheel, at the place where it comes out of the plate in which it moves, carries a square which is laid hold of by one of the two cross pieces between which the watch is carried, which cross pieces are fixed to the box. The other end of the axle, which is round, moves in a hole perforated in the opposite cross piece. This method, though the most simple, is not always so convenient as the following: 2, On one of the cross-pieces above-mentioned is fixed a wheel, O, fig. 3, which cannot turn round. Above the plate of the watch passes the axle of a wheel, on which is fixed a pinion, R, which works in the wheel, O. The wheel-work actuated by the spring not being able to turn the wheel, O, turns quite round it, and, consequently, carries the centre of gravity of the watch quite round the interior circumference of the box, B, fig. 1, and this changes at every instant, and in a regular manner, the centre of gravity of the arrow. If the axle of the wheel which carries the pinion, R, turns round in one hour, and if we wish A B to revolve in twelve hours, then R must have 8 teeth, and O 96; or R 10 and O 120. If A B is to revolve in one hour, then R and O must have the same number of teeth. *Bull. des Sc. Technol.* Jan. 1825, p. 42.

DESCRIPTION OF GRIEBEL'S PORTABLE NIGHT-CLOCK.

This clock, constructed by M. Griebel of Paris, is represented in figs. 4 and 5, the former showing it in perspective, and the latter in section. A, is the globe which contains the clock movement and the lamp, B. The dial-plate, C, has a rim of ground glass with the hours painted upon it, between E and C, fig. 5; E E, is a plate in the centre of the ground glass ring, to which the movement is fixed; F is a globe to protect the wheel-work from dust. The rays of light, B G, B G, issuing from the lamp, B, illuminate the rim, E C, of the dial on which the hours and minutes are painted. *Bull. des Sc. Technol.* Jan. 1825, p. 40.

It would, we think, be an improvement on this clock to place a mirror between G G, to intercept all the rays that do not fall upon the rim of ground glass, which, by means of another mirror behind B, would throw some additional scattered light on the rim itself, while it would protect the wheel-work from the direct radiation of the lamp.

DESCRIPTION OF M. ALLARD'S UNIVERSAL BEVEL.

This useful and ingenious bevel, which is represented in fig. 6, is composed of two rules, *a*, *b*, which open and shut round the joint *a*. The shortest of these two, *b*, carries a portion of a circle, *c*, which passes through a slit in *a*, where it may be fixed by a screw, *d*. The other branch, *a*, is perforated with rectangular mortises, in which are nuts, *e*, of the same form, moving on a transverse pin, *f*, in order to allow the screw, *g*, which passes through them, to incline itself and change its position as may be required. One of these screws is shown separately in fig. 7. Near *a* is fixed a flexible plate of steel, *h*, *h*, *h*, which is jointed by caps, *i*, *i*, and rivetted to the ends of the screws, *g*. In the openings of each of these caps is placed a piece, *k*, with two points, and with the end of the screw fixed in the middle of it, so that the plate, *h*, *h*, *h*, may, by means of the screws, be made to apply to any curve, and retained in that position, so as to be transferred to another substance. *Bull. des Sc. Technol.* Jan. 1825, p. 41.

ON THE GOLD MINES OF NORTH CAROLINA.

By Denison Olmsted, Professor of Chemistry and Mineralogy in the University of North Carolina. *

The gold mines of North Carolina, which have recently become an object of much inquiry both at home and abroad, are situated between the 35th and 36th degrees of N. latitude, and between the 80th and 81st degrees of W. longitude from London. They are on the southern side of the State, not far from the borders of South Carolina, and somewhat westward of the centre. Through the gold country flows the river Pedee, receiving, within the same district, the Uwharre from the north, and Rocky river from the south, both considerable streams. Above the junction with the Uwharre, the Pedee bears the name of Yadkin.

The gold country is spread over

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* From Professor Siliman's American Journal.

a space of not less than 1000 square miles. With a map of North Carolina one may easily trace its boundaries, so far as they have hitherto been observed. From a point taken eight miles west by south of the mouth of the Uwharre, with a radius of 18 miles, describe a circle, it will include the greatest part of the county of Montgomery, the northern part of Anson, the north-eastern corner of Mulenberg, Cubarrus, a little beyond Concord on the west, and a corner of Rowan and of Randolph. In almost any part of this region, gold may be found, in greater or less abundance, at or near the surface of the ground. Its true bed, however, is a thin stratum of gravel inclosed in a dense mud, usually of a pale blue, but sometimes of a yellow colour. On ground that is elevated and exposed to be washed by rains, this stratum frequently appears at the surface; and in low grounds, where the alluvial earth has been accumulated by the same agent, it is found to the depth of eight feet: where no cause operates to alter its original depth, it lies about three feet below the surface. Rocky river and its small tributaries which cut through this stratum, have hitherto proved the most fruitful localities of the precious metal.

The prevailing rock in the gold country is Argillite. This belongs to an extensive formation of the same which crosses the State in numerous beds, forming a zone more than twenty miles in width, and embracing, among many less important varieties of slate, several extensive beds of novaculite, or whetstone slate, and also beds of petrosiliceous porphyry, and of greenstone. These last lie over the argillite, either in detached blocks, or in strata that are inclined at a lower angle than that. This ample field of slate I had supposed to be the peculiar repository of the gold; but a personal examination discovered that the precious metal, embosomed in the same peculiar stratum of mud and gravel, extends beyond the slate on the west, spreading in the vicinity of Concord, over a region of granite and gneiss.

A geographical description of the gold country would present little that is interesting. The soil is generally barren, and the inhabitants are mostly poor and ignorant. The traveller passes the day without meeting with a single striking or beautiful object, either of nature or of art, to vary the tiresome monotony of forests and sand-hills, and ridges of gravelly quartz. Here and there a log hut or cabin, surrounded by a few acres of corn and cotton, marks the little improvement which has been made by man, in a region singularly endowed by nature. The road is generally conducted along the ridges which slope on either hand into vallies of moderate depth, consisting chiefly of fragments of quartz, either strewed coarsely over the ground, or so comminuted as to form gravel; these ridges have an appearance of great natural sterillity, which, moreover, is greatly aggravated by the ruinous practice of frequently burning over the forests, so as to consume all the leaves and undergrowth, giving to the forest the aspect of an artificial grove.

The principal mines are three—the Anson mine, Reed's mine, and Parker's mine.

The Anson mine is situated in the county of the same name, on the waters of Richardson's creek, a branch of Rocky river. This locality was discovered only two years since by a "gold hunter," one of an order of people that begin already to be accounted a distinct race. A rivulet winds from north to south between two gently sloping hills that emerge towards the south. The bed of the stream, entirely covered with gravel, is left almost naked during the dry season, which period is usually selected by the miners for their operations. On digging from three to six feet into this bed, the workman comes to that peculiar stratum of gravel and tenacious blue clay which is at once recognised as the repository of the gold. The stream itself usually gives the first indication of the richness of the bed through which it passes, by disclosing large pieces of the precious metal shining among its pebbles and sands—such was the first hint afforded to the discoverer of the Anson mine. Unusually large pieces were found by those who first examined the place, and the highest hopes were inspired. On inquiry, it was ascertained that part of the land was not held by a good title, and parcels of it were immediately *entered*,* but it has since been a subject of constant litigation, which has retarded the working of the mine.

Reed's mine, in Cubarrus, is the one which was first wrought; and at this place, indeed, were obtained the first specimens of gold that were found in the formation. A large piece was found in the bed of a small creek, which attracted attention by its lustre and specific gravity, but it was retained for a long time after its discovery in the hands of the proprietor, through ignorance whether it were gold or not. This mine occupies the bed of Meadow creek, (a branch of Rocky river,) and exhibits a level between two hillocks, which rise on either side of the creek, affording a space between from fifty to one hundred yards in breadth.—This space has been nearly all dug over, and exhibits at present numerous small pits for the distance of one-fourth of a mile on both sides of the stream. The surface of the ground and the bed of the creek are occupied by quartz and by sharp angular rocks of the greenstone family. The first glance is sufficient to convince the spectator that the business of searching for gold is conducted under numerous disadvantages, without the least regard to system, and with very little aid from mechanical contrivances. The process is as follows:—During the dry season, when the greatest part of the level above described is left bare, and the creek shrinks to a small rivulet, the workman selects a spot at random, and commences digging a pit with a spade and mattock. At first he penetrates through three or four feet of dark-coloured mud, full of stones in angular fragments. At this depth he meets with that peculiar stratum of gravel and clay, which he recognises as the matrix of the gold. If the mud be very dense and tenacious, he accounts it a good sign; and if stains or streaks of yellow occasionally appear on the blue mud, it is a fortunate symptom. Sometimes he penetrates through a stratum of the ferruginous oxide of manganese, in a rotten friable state. This he denominates "cinders," and regards it also as a favourable omen. Having arrived at the proper stratum, which is only a few inches thick, he removes it with a spade into the "cradle." This is a semi-cylinder laid on its side, (like a barrel bisected longitudinally and laid flat-wise,) and made to rock like a cradle on two parallel poles of wood. The cradle being half filled with the rubbish, water is there laded in, so as nearly to fill the vessel. The cradle is now set to rocking, the gravel being occasionally stirred with an iron rake, until the coarse stones are entirely freed from the blue mud, a part of the process which is the more difficult, on account of the dense adhesive quality of the mud. By rocking the cradle rapidly, the water is thrown overboard, loaded with as much mud as it is capable of suspending. The coarser stones are then picked out by hand, more water is added, and the same process is repeated. On pouring out the water a second time, (which is done by inclining the cradle on one side,) a layer of coarse gravel appears on the top, which is scraped off by hand. At the close of each washing, a similar layer of gravel appears on the top, which appears more and more comminuted until it graduates into fine sand, covering the bottom of the cradle. At length this residuum is transferred to an iron dish, which is dipped horizontally into a pool of water, and subjected to a rotatory motion. All the remaining earthy matter goes overboard, and nothing remains but a fine sand, chiefly ferruginous, and the particles of gold for which the whole labour has been performed. These are frequently no larger than a pin's head, but vary in size from mere dust to pieces weighing one or two pennyweights. Large pieces, when they occur, are usually picked out at a previous stage of the process.

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* A piece of land is said not to be *entered* when it remains the property of the public without taxation. Any one is at liberty to enter on the state books whatever land he can find in this situation, the land being secured to him on his becoming responsible for the taxes.

Large pieces of gold are found in this region, although their occurrence is somewhat rare. Masses weighing four, five, and six hundred penny-weights, are occasionally met with, and one mass found that weighed, *in its crude state*, 28 lbs. avoirdupoise. This was dug up by a negro at Reed's mine, within a few inches of the surface of the ground. Marvellous stories are told respecting this rich mass; as that it had been seen by gold hunters at night, reflecting so brilliant a light, when they drew near to it with torches, as to make them believe it was some supernatural appearance, and to deter them from farther examination. But all stories of this kind, as I was assured by Mr. Reed, the old proprietor, are mere fables. No unusual circumtances were connected with the discovery of this mass, except its being nearer the surface than common. It was melted down and cast into bars soon after its discovery. The spot where it was found has been since subjected to the severest scrutiny, but without any similar harvest. Another mass weighing 600 dwts. was found on the surface of a ploughed field in the vicinity of the Yadkin, twenty miles or more north of Reed's mine. Specimens of great elegance, as I should infer from the descriptions of the miners, are occasionally found, but for want of mineralogists to reserve them for cabinets, they have always been thrown into the common stock and melted into bars. Mr. Reed found a mass of quartz, having a projecting point of gold, of the size of a large pin's head. On breaking it open, a brilliant display of green and yellow colours was presented, which he described as exceedingly beautiful. The gold weighed 12 dwts. The mineralogist may perhaps recognise in this description, a congeries of fine crystals, but on that point the proprietors could not inform me. Although fragments of greenstone and of several argillaceous minerals, occur among the gravel of the gold stratum, yet, in the opinion of the miners, the precious metal is never found attached to any other mineral than quartz. Indeed it is rarely attached to any substance, but is commonly scattered promiscuously among the gravel. Its colour is generally yellow, with a reddish tinge, though the surface is not unfrequently obscured by a partial incrustation of iron or manganese, or by adhering particles of sand. The masses are flattened and vesicular, having angles rounded with evident marks of attrition. The rounded angles and vesicular structure lead to the opinion, which is very general, that the metal has undergone *fusion;* but any one who inspects the specimens narrowly, will be convinced that their worn and rounded appearance is owing to attrition, and that the cavities are produced by the indentation of sand and gravel, the exact impress of which may be observed, and particles of them may still frequently be seen imbedded. The gravel, moreover, which is separated by washing, bears evident marks of attrition, of *a limited duration,* sufficient to round its edges and angles, but not sufficient to destroy them: the fragments are not ovoidal, like the pebbles of rivers, but are still flat, retaining their original form, except that their edges are dull, and their angles blunted. In short, the whole appearance is such, as would naturally result from so soft a substance as virgin-gold, being knocked about among such stern associates as quartz and greenstone.

The appearance of fusion, supposed to be exhibited by the gold, has inspired the idea among the miners, that the small pieces which they obtain have been melted out from some *ore* that lies disguised in the vicinity. This idea has frequently made them the dupes of imposition. The mineral rod, charms, and other follies, have had their reign here, and the first is still held in some estimation. The common rocks and stones of the country have been tortured by a new race of alchymists, who have imagined them to be the ore of gold, veiling, under some disguise, the characters of the precious metal. A great degree of eagerness also pervades the country on the subject of the metals in general. The minerals thrown out in excavating pits in search of gold, consist chiefly of quartz, greenstone, and hornblende mixed with chlorite, and afford little that is interesting to the collector of specimens. Almost the only substance which I met with, that was worth preserving merely as a specimen, was *Pyritous Copper.* Of this I saw some elegant fragments. It occurs in a gangue of quartz, and resembles that found at Lane's Mine at Huntington, Con. (*Amer. Journal of Science,* vol. I. p. 316.) A vein of it occurs in slaty clay, six miles east of Concord, in Cubarrus county. This ore had been subjected to numerous experiments, on account of the belief that it was the " ore of gold," above mentioned; and, although the experiments did not lead to the discovery of gold, yet a " German miner and mineralogist" had, it was said, detected PLATINA in it. On searching into the evidence of so unexpected a result, I was informed that a white metal was produced from this ore, which was not lead, nor tin, nor silver, but answered perfectly to the description of platina, although, as they acknowledged, it was easily fused, and burnt with a blue flame. I suspected it to be *metallic antimony;* but still could perceive no signs of that metal in the ore. I requested a minute account of the process.—" The materials, namely, the ore, charcoal, borax, &c. were put into a crucible —emetic tartar, in considerable quantity, was added to make the ore 'spew out' the metal. Ipecacuanha was afterwards tried with the same view, but was not found to be strong enough 'to make the ore vomit.'" After the account of the process, it was not difficult to account for the production of antimony, it being obviously derived from the emetic tartar.

(*To be continued.*)

METHOD OF PREVENTING THE FRACTURE IN GLASS CHIMNEYS.

The glass chimneys which are now in such extensive use, not only for oil lamps, but also for the burners of oil and coal gas, very frequently break, and not only expose to danger those who are near them, but occasion very great expense and inconvenience, particularly to those who are resident in the country. The bursting of these glasses very often arises from knots in the glass where it is less perfectly annealed, and also from an inequality of thickness at their lower end, which prevents them from expanding uniformly by heat. The best method of detecting the knots, is to examine the glasses by polarized light, and reject those that exhibit at the knots the depolarized tints.

M. Cadet de Vaux (*Bull. des Sc. Tech.* Mars 1825, p. 180,) informs us, that the evil arising from inequality of thickness may be cured by making a cut with a diamond in the bottom of the tube, and he remarks that, in establishments where six lamps are lighted every day, and where this precaution was taken, there was not a single glass broken for nine years.

ON THE CONSTRUCTION OF ÆOLIAN HARPS.

I shall first speak as to form.—It is essential that the length of the harp exactly fit within the frame of the open window; for should it be longer than the transverse aperture, it cannot be brought immediately under the perpendicular plane of the sash, so as to insure the sweep of air in contact with the strings. If it be shorter, much effect will be lost, by part of the current passing between the ends and the uprights. But the latter evil is the most easily remedied; because a sliding piece may work on the front, facing each end, and be projected forth, as the deficiency in length may require, so as to block up the horizontal passage of the air, equal to the depth of the instrument. I have adopted this means to fit a harp for windows wider than those it was originally designed for, and with partial efficacy. I say partial, because the defect cannot wholly be supplied, on account of the wave of air surmounting the upright slides, and dipping downwards; which takes off from the horizontal sweep. Possibly I may seem, to the inexperienced in harps, to lay more stress on the accurate fitting than may be necessary; but he who will put this matter to the test by actual experiment, will agree with me that the tones and powers of the instrument are greatly modified by such contingency. It is not uncommon to make up the defect in length, by stuffing paper or linen in between the ends of the instrument and the window-frame; but this is an absurd practice; for it muffles the harp, by diminishing its elasticity. And here I ought to add, that not any part of the instrument should come into contact with inelastic matter; consequently, it is injurious to cover its bottom with baize, as is frequently done; but with what view I cannot conjecture. The depth of the harp should never be less than three and a half inches, nor exceed five. This depth to be regulated by the length; for the longer the instrument, the deeper must it be. The breadth should not exceed five inches; for if made broader, the air will act on the middle strings only, without there be such a parallel plane to confine the sweep of current, as I shall hereafter speak of. The length, as before said, should always be exactly that of the width of the window aperture, which, in the largest, seldom equals four feet and a half. Next, as to the material of construction. The more elastic the better; therefore, if of wood, it should be similar to that of a violin, both in quality and thickness, the bottom excepted, which should be stronger, as a base for bearing the stress of the joined pieces, and the contractile draught of the chords. The breadth of the bridges, which should be of ivory, or very hard wood, may vary from half an inch in the shortest harps, to three quarters in the longest.

Another point, essential to be borne in mind is, that the ultimate effect will be much governed by the degree of elasticity in all parts of the harp; therefore, the wood must not only be perfect in its texture, but also thoroughly seasoned and dry; or the relative states of atmospherical humidity will produce variable powers. The wood, then, after being perfectly dried, should be varnished with *hard* varnish, on both sides, before the parts are joined together, and again on the outside when constructed. For want of attention to this matter alone, many of the harps sold in the shops are not worth having. A simple method occurred to me of constructing the harp, and which has more than answered my best expectations. Instead of using wood for the entire box of the instrument, it may be made thus:—Having the bottom piece about a quarter of an inch thick, and prepared of the due length and breadth, raise a frame from it of equal length and breadth, and of the depth intended. This frame must be covered with parchment, or thick drawing paper, well stretched, dried, and varnished with flexible varnish. In fitting on the parchment or paper, it must be extended so as to render it as tense as possible; and all the joinings must be fastened with tough strong varnish, and these joinings should be made to fall on the frame part. When the whole box is put together, it should have two coatings of hard varnish on the outside. Instead of cutting the upper side for a sound vent, holes may be pricked until the effect be full; but I would recommend not to be too profuse in punctures, for many instruments are enfeebled in power by the air vent being too large. This mode of construction, if properly executed, will produce a highly elastic and excellent instrument, the best that can be made, glass only excepted. I must not, however, conceal that it requires nice and delicate management to duly extend the material, and unite the joints. I presented one to a friend who has had it in persevering use for more than eleven years, and its tones, which were remarkably fine at first, are, if possible, improved by time. This gentleman fully agrees with me that it far surpasses the very best made of wood. I need not detail the manner of constructing the frame; for every person's ingenuity must be equal to devising the form, and any tolerable carpenter equal to the workmanship. I once constructed a harp of glass, but it unfortunately broke under the vibration of the first string, which I was impatient to sound. I shall never, while I live, forget the tone, it was so transcendently full, mellow, and rich; it seemed like a sweep of melody pervading the whole empyreum. Attributing the fracture of the glass to the violent atomical vibrations excited in it by the oscillation of the string, and despairing of being able to construct another of similar materials, that could resist the impulses to which its texture must be exposed, I abandoned it altogether: such hazardous trials being too expensive and too troublesome for mere gratification. The preceding observations apply, not only to the common Æolian harp, whose strings all equally extend to nearly the full length of the instrument, but also to those with graduating strings; the latter of which form of construction is certainly preferable, where the harp is very long. This brings me to the consideration of vibrating chords.

Every Æolian harp should have, besides its common chords, or strings, a fundamental, or bass one, of that kind called bass fiddle-string. The others should be the common violin catgut strings, and perfect in their quality; that is, transparent, firm, even throughout their lengths, and all as nearly equal in thickness as can be selected. Previous to using these latter, they should be wiped dry, a little warmed, and then well resined, to prevent the effect of a moist atmosphere. When the harp is laid aside, the strings should be relaxed; for the common practice of putting the instrument aside with all its strings in a state of tension, is dangerous to the harp. It may be warped by their contraction, if the atmosphere become moist, and the strings be not waterproof; or the strings themselves may fly.

With respect to the best method of stringing, I would say, that where the window aperture is moderate (three feet or under) in length, probably it may be best to carry the strings of equal length, and as long as the instrument will admit, so as to allow convenient space to work the pegs and screws at each extremity. In speaking of form, I forgot to mention the blocks of beech-wood, that are to be inserted within each extreme end of the box, for the screws and pegs to work in. They should each be about an inch wide, and of equal length and depth with the width and depth of the box; and they must be fixed perfectly firm to its ends. The pegs and screws should always be of metal, that is, the common harpsichord ones; half of each being fixed in each end, so that the traction of the strings be in opposite directions. But to return to the stringing. If the harp much exceeds three feet, it will be better to use the graduating than equal lengths. I presume the reader to be informed, that if two vibrating chords, being in unison, running parallel and near to each other, be of different lengths, the vibration of the shorter will govern that of the latter, in the proportion of its multiple. Thus, if the shorter chord be four inches long, and the longer sixteen inches, on vibrating the shorter, the longer will instantly and spontaneously vibrate in four separate parts or portions; each portion forming as it were a distinct vibrating chord, similar to the short one. In accordance of this principle, I would recommend the following proportions. Suppose the harp to a little exceed four feet, the bass string must be 48 inches, the next common string of similar length;

then the common ones should run 36, 24, 18, 12, 8, 4, or some analogous extents. This number of strings is ample for the largest instrument: for when they are too abundant, the undulating air excites rather a congregation of tones than a due succession, wherein the variety and melody are individually developed to our distinct perception. Indeed, one single string properly stretched will afford all the varied tones of sound, and sometimes an apparent combination, but the effect is transient, and, in order to sustain a continued succession, there must be several strings exposed to the vibrating impulse of the air.

(*To be continued.*)

EASY MODE OF COPYING DRAWINGS.

Gentlemen,—I have for a long while practised the following easy method of obtaining a neat picture.

If I find a print any where, that I should like a separate copy of, I adopt the following plan:—Lay out the sheet whereon the plate is, upon a smooth table with the print uppermost, place upon it a sheet of clean paper, held firm in the same position, then take a separate piece and lay it upon this, (the use of which is to save the paper upon which the impression is received from getting glazed by the friction and pressure,) and rub smartly and firmly upon the figure with a paper cutter, or some such thing, for a short while. On the paper being taken up, a beautiful impression of the figure will be found on it.

This method will not be found effectual when tried upon copperplates, without it be done immediately after the print is from the press, and even then but a faint impression is obtained. Wood and lithographic prints, however, give off one or two most distinct impressions. You will perceive the impression thus obtained will just be the reverse of that from which it is taken, but the position of many is immaterial. However, if a fac simile be wanted, nothing more need be done than to take a very distinct impression from the plate, and from that take another on a separate sheet, which is quite practicable. A pencil etching can also be taken off in this way very neatly.

The above is no doubt known to many, though I am convinced it is not generally known, and should it be worth insertion in your work, it may be found new to some one.

I am, yours, &c.

D.

Glasgow, 7th Sept. 1825.

NEW SCARLET COLOUR.

Mr. Badams has recently described a process for obtaining scarlet chromate of lead; and highly recommends its use as a colour either in painting or calico-printing. He prepares the scarlet chromate by boiling yellow chromate of lead with potash; and has made several experiments upon the properties of the scarlet colour thus obtained. It appears that it may be made what is called a fast colour in calico-printing, and that it is a durable and beautiful colour when used with oil, possessing considerable body. It is not degraded in its hue by admixture with white lead, as vermillion is; and it also mixes with other colours. As a water-colour, it has not been sufficiently tried to render it certain that it will not blacken; but several slips of card and thin paper, painted with it, and hung up in situations likely to affect colour, have not, in some months, perceptibly diminished in brightness. Mr. Badams very justly remarks, that should it succeed, no tint would be a more desirable accession to the pallet than a bright and permanent scarlet, or scarlet orange.

ON HARDENING AND TEMPERING CAST-STEEL.

For saws of the usual description, and springs in general, the following is an excellent hardening and tempering liquid; *viz.* twenty gallons of spermaceti oil; twenty pounds of beef suet rendered; one gallon neat's foot oil; one pound of pitch; three pounds of black rosin.—These two last articles must be previously melted together, and then added to the other ingredients; when the whole must be heated in a proper iron vessel with a close cover fitted to it, until all the moisture is entirely evaporated; and the composition will take fire on a flaming body being presented to its surface; but which must be instantly extinguished again, by putting on the cover of the vessel. The cast-steel articles, if thin or slender, may be quenched in this composition, in order to harden them; and then be blazed off, as the operation is termed, over a clear fire in order to temper them. If the articles are *thick*, such as sword-blades, &c. they should be previously hardened by quenching them in rain water: and then be tempered by wiping them over, on both sides, with a thin coating of the tempering liquid applied by means of a round hand-brush, and then be blazed off in order to temper them.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION VI.

Manganese.

This substance can scarcely be reckoned a direct agent in bleaching, but as the most important agent used in the art is made from it, in an essay of this kind it would be unpardonable to omit its consideration. The best manganese is raised at Upton Pine in Devonshire, from a mine which seems adequate to the supply of the whole island for a century to come; most other kinds are of little use to the bleacher, as they require a greater proportion of sulphuric acid to saturate them, and with all, produce less oxygen. It is the black oxide of manganese which is used in the manufacture of chlorine, and it is this oxide which is procured from the mines. Besides the mines at Upton Pine, there are manganese mines at Bristol, and in Ayrshire, Aberdeenshire, and in various parts of Europe and America. That from Bristol and the Mendip hills is the worst, as it is generally contaminated with lead. The black oxide, when good, is of a bluish black colour and shining lustre; when saturated with oxygen it contains 44 parts of that substance, and 66 of the metal; but as it comes from the mines, it more commonly contains about 40 per cent. of oxygen, or even less. The substances with which it is most liable to be contaminated are the oxides of lead, iron, and the carbonate of lime, and when it contains any of these in quantity, the quantity of chlorine which it is capable of developing is proportionally less.—The carbonate of lime may be detected in the oxide of manganese, by pouring on it a quantity of nitric acid diluted with ten parts of water, when, if chalk is present, an effervescence will take place, and the lime will combine with the test liquor, while no effervescence will follow if lime is not present. In the former case, let the test liquor stand on it till it has taken up all the lime in the specimen, and then precipitate this lime by adding carbonate of potash to the solution. The weight of the precipitate will indicate the extent of the contamination. The presence of lead may be discovered by the sulphuric acid, or by Harrowgate water, with either of which it will form a dark brown or black precipitate, insoluble in water. Or take equal parts of oyster shells and sulphur, keep them in a white heat for a quarter of an hour, and when cold, add to the mixture an equal quantity of super tratrite of potash. Boil the whole in a strong bottle with rain water for an hour, when there may be added to the liquid, twenty drops of muriatic acid for every ounce, to prevent the test from affecting any iron which may be present. This re-agent produces from lead a black precipitate, and will detect the most minute portion of that metal.—(Watson's Chem. Ess. III.)

The ores of iron are less easily detected in the oxide of manganese. When the iron, however, contains a proper proportion of oxygen for rendering it soluble in muriatic acid, we may thus discover its presence. By means of heat make a solution of the oxide of manganese to be tried in strong muriatic acid, add to the solution a considerable proportion of distilled water, and pour into this liquid a solution of crystalized carbonate of potash. If the manganese contains iron, it will by this means be precipitated in the state of an oxide, while the manganese will remain suspended by the excess of carbonic acid. Or the iron may be separated by the nitric acid with the addition of sugar, which will combine only with the manganese.

ESSAY ON COMPOSITION.

> First follow nature, and your judgment frame
> By her just standard, which is still the same:
> Unerring nature, still divinely bright,
> One clear, unchang'd, and universal light,
> Life, force, and beauty must to all impart
> At once the source, the end, the test of art.—*Pope.*

Gentlemen,—In No. LXXX. of your valuable Magazine, I gave an Essay upon Composition, which I have reason to believe has not been altogether vain; for, to the rules therein imposed and exemplified, I find, in some posterior Numbers, a marked conformity. In the essay in question, I made a partial promise to resume the subject, and amplify examples. Wherefore, as I have already treated the construction of words, I shall, in this attempt, under leave of you, confine myself to the construction of sentences, which unquestionably is the second essential in composition.

Rule I. Introduce your subject coolly and deliberately; and if your initiating proposition be dubious, let it be followed up by some corroborant allegation, or allegations. Example:

——— "Therefore, what he gives
(Whose praise be ever sung,) to man in part
Spiritual, may of purest spirits be found
No ingrateful food: and food alike those pure
Intelligential substances require,
As doth our rational.—
For know, whatever was created, needs
To be sustained and fed: of elements
The grosser feeds the purer; earth the sea;
Earth and the sea feed air," &c.

I would by no means stop to prop every proposition; if their fall does not endanger the life of the narrative, I would leave them to chance; but the assertion here that angels require food, which, to say the least of it, is capable of a doubt, it were pity to leave unnoticed, unsupported, unimproved.—Should the position not easily admit of a corroborant allegation, let imagination draw upon analogy, which may equally serve the purpose. Example:—

——— "Consider first, that good
Or bright infers not excellence; the earth,

Though in comparison of heaven so small,
Nor glist'ring, may of solid good contain
More plenty than the sun that barren
shines."

This mode may perhaps be called *argumentum ad judicium.*

Rule II. In treating a point of moment or magnitude, use, as much as may be, the exclamatory, or, as the subject requires, the interrogatory style. Example:—

"Could you discern the late companions of your wanton hours overwhelmed with torment and despair? could you hear them upbraiding *you* as the partners of their crimes? could you hear them accusing you as in some measure the cause of their damnation? Great God! how would your hair stand on end! how would your heart die within you! how would conscience fix all her stings!" Or thus:—

——"But first, whom shall we send
In search of this new world? whom shall
we find
Sufficient? who shall tempt with wandering feet
The dark, unbottomed, infinite abyss,
And through the palpable obscure find
out
His uncouth way?" &c.

Of this mode of composition, it is needless to commend the beauty. Like every beauty, it carries its own demonstration along with it; when due regard is paid to the rising and falling inflection, it constitutes a mode of argumentation not only the most impressive and harmonious, but likewise the most cogent, most sublime, most convincing. It may be called *togadh riusan fianuis.*

Rule III. When you would unravel any intricate point, and strongly urge your own opinion; divide your sentence into three distinct members, each member commencing with the same words, but terminating with words conveying different ideas. Example:—

"He is a traitor to his country, he is a traitor to the human kind, he is a traitor to heaven, who abuses the talents God has given him." Or thus: "Let us march against Phillip, let us fight for our liberties, let us conquer or die."

This feature in composition is most graceful, and becomes an orator well. In reading it, the middle member of the sentence must be read two notes louder than the first, and the last member a note lower than the first, and commonly with the falling inflection.

Sometimes three or more kindred words may have the same happy effect, in which case we should have a view, if possible, to alliteration. Examples:—

"There to converse with everlasting
groans
Unpitied, unrespited, unreprieved."

"Among innumerable false, unmoved,
Unshaken, unseduced, unterrified."

In most modern compositions of this nature, the last member, or the last word, is wedded to the preceding by the conjunction AND. This alliance I would unmercifully reprobate. It unnerves the parties; it debilitates the structure; let them be divorced. This mode may be denominated *argumentum ad passiones.*

Rule IV. In asserting a point, in itself obvious, and admitting of a great and clear contrast, instead of an affirmative, use rather two negatives, or perhaps one negative together with the opposite term or idea of what you would affirm. Examples:—

—— "Fast we found—fast shut
The dismal gates and barricadoed strong,
But, long ere our approaching, heard
within
Noise, *other than the sound of dance and
song.*"

"So Zophiel on the approach of the
Satanic
Host, with their 'hollow engines' ready
to
Discharge their 'missive ruin'"——

—— "This day will pour down,
If I conjecture ought, *no drizzling shower.*"

Who that does not see the beauty of the contrast here? Who that does not prefer the expression, "other than the sound of dance and song," to *groans* and *cries?* and who that does not prefer "no drizzling shower" to *a heavy shower?* So when *Sin* calls "each herb, and fruit, and flower; each beast, and fish, and fowl, *no homely morsels,*" and when Paul calls himself "a citizen of *no mean city,*" it is a much happier method of expression than if Sin had said *sweet morsels,* or Paul had called himself a citizen of a *respectable city.* To say that Absalom was *no uncomely man*, or that Samson was *no woman*, or *no Lilliputian*, I would approve in composition before calling Absalom *a bonnie man*, or Samson *a strong man*.

Should my brother mechanics find any thing useful in the preceding observations, they will have answered all the motives of

LACHLAN M'LEAN.

Vastfield, Isle of Coll, Sept. 1825.

MISCELLANIES.

Light produced during the Crystallization of Benzoic Acid.—M. Buchner of Magonza having mixed impure, but perfectly dry, benzoic acid with the sixth part of its weight of pulverised charcoal, left it exposed, for several days, to a moderate heat, the mixture being covered with a cylinder well luted with a paste of almonds, but having a small aperture left on purpose to see the crystallization within. Having been exposed, for several days, to a moderate heat, the crystals had already begun to form, but being desirous of hurrying the operation, M. Buchner placed the apparatus in a stove of a high temperature. In the space of half an hour he was surprised to see a brilliant flash of light within the cylinder, the brightness of which was augmented by the darkness of the room. A number of similar flashes immediately succeeded, and continued for half an hour. M. Buchner now found that a great quantity of crystals of benzoic acid were formed similar to those obtained in the usual way, but only less regular. As the flash did not continue after each crystal was deposited, M. Buchner thought that the light was produced by a neutralization of electricity. M. Buchner observed similar phenomena in the crystallization of acetate of potash, and M. Dobereiner observed the same in the preparation of oxygen by means of a mixture of oxygenated chlorate, potash, and manganese in powder. The last of these chemists is of opinion, that those salts which contain no water of crystallization, are particularly powerful in producing light during crystallization.—See *Neue Journ. fur Chem. und Phys.* 1824, vol. ii. p. 222, and *Giorn. de Fisica*, vii. 470.

Iridescence of Clouds.—M. de Humboldt mentions this phenomenon as having been seen by him in South America, but I have not met with any notice of its having been seen in this country, though it has most likely been witnessed by some of our meteorologists who are accustomed to observe the nepheological phenomena. On the morning of the 13th of December last, we had a hard gale from the N. W., with black and dense cumulostrati driving rapidly in the direction of the wind. At 9½ A. M., when examining the appearance of the heavens through an opening in the cumulostrati, I observed an extensive cirrostratus resting motionless in a higher region of the atmosphere, stretching from S. E. to E., and rising about 5° above the horizon, the sun at that time being about 7° or 8° high. This cirrostratus exhibited all the prismatic colours in broad alternate stripes. There were four alternations, and the tints being very brilliant, it formed a most beautiful spectacle. It lasted till 11 A. M. when the colours gradually faded, and at last blended into a uniform yellowish brown. Since that time I have frequently seen the same phenomenon shortly after sunrise, when the rays of the sun are incident at small angles, upon a thin and shallow cirrostratus.

The cause of the iridescence is not easily explained, but it seems to be connected with the magnitude of the aqueous globules of which the cloud is composed.

I may give another instance, which took place on the 21st of January, wind brisk, from the W. by N., Hygrom. 35. : an extensive black cloud veiled the heavens, extending from N.E. and W. to within 10° of the southern horizon. The sun's place was completely obscured; but a small portion of the south edge of the cloud had a dazzling yellow colour. At this time a chain of *scud*, flying from S. to S. E., crossed in succession the illuminated part, each, as it passed, suddenly displaying a splendid show of prismatic tints, and then returning to its original sombre hue. I watched this interesting sight for ten minutes, when a nimbus approached, and effectually darkened all that part of the heavens.

Electricity developed in Capillary Attraction.—M. Becquerel is said to have demonstrated, that there is a sensible developement of electricity during the ascent of liquids in capillary tubes. He first obtained this result by increasing the sensibility of Schweigger's galvanometer. He placed three of these instruments together, so that the magnetic needle of the middle one deviates from its ordinary direction, by the lateral effects produced upon each of its poles by the contrary poles of the two other needles. From this arrangement it follows, that, when an electric current passes into the apparatus, tending to bring the needle into the plane of the magnetic meridian, the middle needle will be as much less retarded in its progress as the poles, opposite to its own, of the other two needles are more remote from it, consequently, the oscillations will have a wider extent than if there were only one galvanometer.

In order to observe the electricity of capillary action, M. Becquerel could not employ glass, as it is not a conductor of electricity; but he employed sponge of platinum and small pieces of charcoal. Pure hydrochloric acid, much diluted with water, is poured out into the platinum dish, which communicates with one of the ends of the wire of the galvanometer; and into the dish is plunged sponge of platinum, which is fixed at the other end of the wire. At this contact there is produced an electric current, which goes from the sponge to the acid, and the direction of which is contrary to that of the current which would have been obtained if the acid had been attacked by the metal. As the interstices of the sponge are filled with the fluid, the current diminishes, and it ceases when the sponge has absorbed all the liquid which it can contain. Sometimes the current takes another direction, but the cause of that is not known. The same effect is produced with nitric acid, but it is less marked. The same result was obtained with a small piece of charcoal, prevented from touching the platinum by a band of *papier Joseph*.

Electricity developed in Solutions and Mixtures.—By means of the same apparatus, M. Becquerel has discovered that an electrical current goes from the acid to the water, when sponge of platinum, that has imbibed distilled water, is plunged into the dish of platinum containing hydrochloric acid.

In order to observe the electricity of solutions of alkalis in water, he fixed in the platina pincers a fragment of hydrate of potash or soda, enveloped in *papier Joseph*, and then plunged it into distilled water in the platina cup. A current was thus produced from the water to the alkali.

M. Becquerel also found that electricity was developed during the mixture of sulphuric and nitric acids.—*Bull. des Sc. Phys.*, &c. Fev. 1824, p. 99.

A Varnish for Wood that will resist the Action of Boiling Water.—Take a pound and a half of linseed oil, and boil it in a copper vessel not tinned, suspending in the oil a small linen bag containing five ounces of litharge and three ounces of minium, both pulverised, taking care that the bag does not touch the bottom of the vessel. Continue the ebullition till the oil acquires a deep brown colour; then take out the bag, and substitute another bag containing a clove of garlic. Continue the ebullition, and renew the garlic seven or eight times, or else put the whole in at once. Then throw into the vessel a pound of yellow amber, after having melted it in the following manner. To a pound of well pulverised amber, add two ounces of linseed oil, and place the whole on a strong fire. When the fusion is complete, pour it boiling-hot into the prepared linseed oil, and let it continue to boil for two or three minutes, stirring it well. Let it rest, decant the composition, and preserve it when cold in well stopped bottles. After having polished the wood on which this varnish is to be applied, the wood is to have the desired colour given to it; for example, for walnut-tree, a slight coat of a mixture of soot with oil of turpentine. When this colour is perfectly dry, lay on a coat of varnish with a fine sponge, in order to distribute it equally. Repeat these coats four times, always taking care to let one coat dry before the next is applied.

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A Committee of Civil Engineers and Practical Mechanics.

> " Meanwhile, whate'er of beautiful or new,
> Sublime or dreadful, in earth, sea, or sky,
> By chance, or search, was offer'd to his view,
> He scann'd with curious and romantic eye."

No. XCVI. *Saturday, 22d October,* 1825. Price 3*d.*

MESSRS. BURSTALL & HILL'S STEAM CARRIAGE, &c.

Fig. 1.

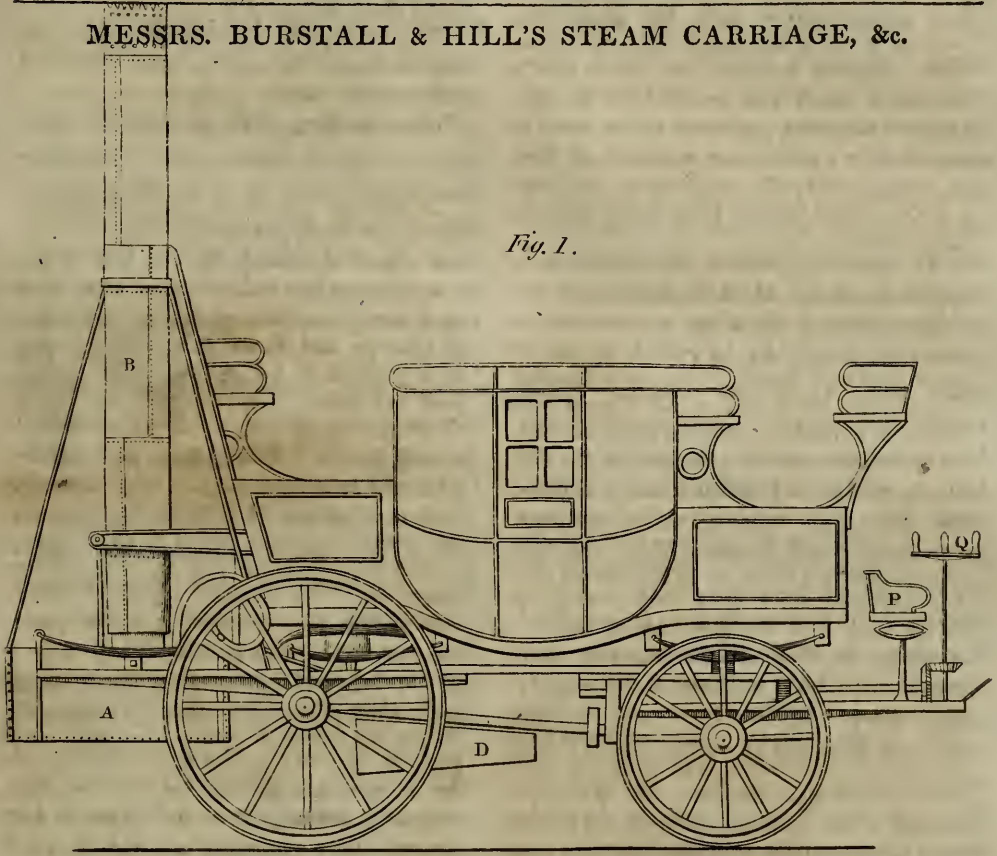
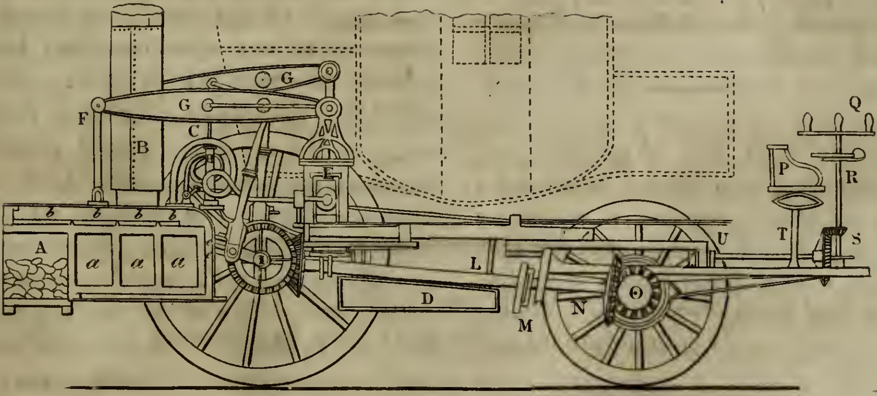


Fig. 2.



— Swan. Sc. —

MESSRS. BURSTALL & HILL'S STEAM CARRIAGE.

THE successful application of steam as a moving power for vessels, created a strong desire to extend its use to carriages; and since that wonderful epoch in the history of navigation, innumerable attempts have been made, though hitherto with very partial success, to produce a carriage which should possess the very superior advantage of having a moving power within itself, completely under the control of its attendants. This has, to a certain extent, been effected, indeed, upon railways, and the loco-motive steam engine is to be seen in many parts of the country moving majestically onwards, dragging in its train waggons and carriages loaded with coals and goods: but it seems to be thought quite impossible by many, ever to produce a loco-motive carriage which will become generally useful, or which can be driven along ordinary roads. There is certainly, however, no real ground for any such conclusion, nor for supposing that a loco-motive carriage may not be invented which will yet fulfil all the purposes of the present stage coach. Indeed, so far are we from thinking in this way, that we have not the smallest doubt that this desideratum in travelling by land will yet be accomplished.

Whether the steam carriage invented by Messrs. Burstall & Hill, and which is now nearly finished, is destined to accomplish this or not, cannot as yet be stated; but the intended trial which is to take place in the course of a week or two, will in all probability set this at rest. We have made arrangements for giving an early account of the trial, and, at the same time, we will be able to state particulars with regard to the velocity at which it will be propelled, the coals and water necessary to generate the proper quantity of steam, and other circumstances which at present can only be conjectured; but in the meantime we have procured an account of the carriage from a friend in Edinburgh, with which we at present beg so far to satisfy the curiosity which has been excited with regard to it.

This loco-motive or steam carriage, our readers will perceive from examining fig. 1 of the engraving, (which represents the appearance it will have when finished,) is a four-wheeled coach, and the machinery to be employed in propelling it is situated partly at the hinder end, and immediately under the seat which in ordinary coaches is occupied by the guard, and partly beneath the body of the coach. This machinery is so disposed as to make but an inconsiderable addition to the bulk of the vehicle. The coach or carriage for the passengers is as usual hung on springs; is placed between the hind and fore wheels, but somewhat nearer the latter than is generally the case; and is otherwise to be of the ordinary description, with seats for the ordinary number of inside and outside passengers. The distance between the wheels across is the same as in common coaches; but the length of the perch, or the distance between the fore and hind wheels is one foot greater. The following description, with a reference to the engraving, will explain more clearly the disposition of the various parts, the nature of the machinery, in which there is a combination and employment of principles, some of which are new in their application to this purpose, and others well known and in general use.

A, *a*, *a*, *a*, represents the boiler situated immediately behind the axle of the hind wheels, and having its upper surface nearly on a level with the axle. It is here represented in section. This boiler is a cube of strong malleable plate iron, about 3 feet long, 3 feet broad, and 2 feet deep, and which incloses a stout cast iron flue, which goes in a circular direction from the fire-place around the boiler, until it ends in the centre, immediately under the funnel, up which the smoke makes its escape. A is the fire-place, and part of the flue is shown at *a*, *a*, *a*. B is the funnel which ascends from the boiler immediately behind the guard's seat; it is about 9 inches diameter, and 7 or 8 feet high. The top of the flue is formed into a number of shallow trays, *b*, *b*, *b*, or receptacles for containing a small quantity of water to be converted into steam, which is afterwards contained for the use of the engine in the space, *c*, *c*, between the flues and the outer wrought metal case. The great object the patentees have had in view, is the peculiar construction of the boiler, so as to make it a store of caloric; they proposing to heat it from 250 to 600 or 800 degrees of Fahrenheit, and by keeping the water in a separate vessel, and only applying it to the boiler when steam is wanted, they accomplish that great desideratum in the application of steam to common roads, of making just such a quantity of steam as is wanted; so that when going down hill where the gravitating force will be enough to impel the carriage, all the steam and heat may be saved to be accumulating and given out again at the first hill or bad piece of road, when more being wanted, more will be expended.

The cistern, D, for holding the water, is shallow, square, and made of copper, is situated immediately under the perch, and will contain a sufficient supply of water for one stage, *viz.* from 50 to 90 gallons. This cistern is air-tight and capable of sustaining a pressure of about 60 pounds to the square inch. A supply of water is forced out of this cistern through pipes into the boiler by one or more air-pumps, at such times and in such quantities as may be wanted. There are two cylinders fitted up with pistons and valves in the usual way, for the alternate action of steam above and below the pistons, but only one of these cylinders can be seen in the engraving, which is shown at E. The cylinders are of 7 inches diameter and 12 inches stroke, and are situated where the boot is usually placed, and somewhere about a foot before the hind axle. The steam is conveyed from the boiler to the cylinder by the pipe, C, and in order to give it elasticity sufficient to withstand the shock occasioned by the jolting motion of the wheels on rough roads, and to give allowance to the play or vibrations of the boiler, which is suspended on springs, without injuring the steam joints, the steam pipes, as well as all the others necessary, are made in a helical form.

On the top of the boiler are fixed two rocking standards, one of which, F, is seen in the engraving. G, G, are the two beams, about 3 feet long, connected at the one end to these rocking standards, and at the other to the piston rods working in the cylinders. About the middle of both beams, a small piston rod is attached to them, each rod working in an air pump, one of which is seen at H. These air pumps are therefore worked by the beams of the engine, and, as already mentioned, by the pressure of air, force the necessary supply of water from the cistern, D, to the boiler. To the beams are likewise attached, at less than a foot from the piston rods, two connecting rods, H, H, the lower ends of which are attached to two cranks, I, I, formed at angles of 90 degrees from each other on the hind axle. These cranks, therefore, by the action of the steam, give a continued rotatory motion to the wheels without the necessity of any fly-wheel. The wheels, in consequence of the great weight upon them, take a firm hold of the ground, and roll the machine forward.

The four wheels are attached to the axles nearly in the same manner in which coach wheels usually are, except that there is a ratchet-wheel formed upon the back part of the nave, with a box wedged into the axle, containing a clog or pall with a spring on the back of it, for the purpose of causing the wheels to be impelled when the axle revolves, and at the same time allowing the outer wheel, when the carriage describes a curve, to travel faster than the inner one, and still be ready to receive the impulse of the engine, as soon as it comes to a straight course. The cylinders, beams, and other working gear, are all above the level of the axle, and will exactly occupy the boot of the carriage, which, in this case, will be merely a cover for this portion of the machinery. The boiler, the cistern, and steam cylinder, are so placed as to balance one another on the opposite sides of the axle of the hind or large wheels, which will very properly sustain two-thirds of the weight.

The fore wheels are, of course, small, as in common coaches, and may or may not receive the application of the steam power. They are made to roll without it; but in the event that, in ascending steep acclivities, the friction of both may be required, the patentees have likewise contrived machinery for communicating the rotatory motion of the hind wheels to them. This part of the machinery can be applied at any time, and plays idly when not needed. This part of the machinery consists of a pair of mitre wheels, one being on the hind axle, and the other on the longitudinal shaft, L, on which shaft is a universal joint, M, directly under the perch pin. This enables the small shaft, N, to be turned, though the carriage should be on the lock. Fixed to the end of the shaft, N, is one of a pair of bevel wheels, the other of which is on the fore axle, and these wheels bear the same proportion to one another that the fore and hind wheels of the carriage do, and this causes their circumference to move on the ground at the same speed.

Over the axle of the fore wheels, and rather lower down than the seat usually occupied by the driver of a coach, is a seat, P, where the conducter sits, with the steering wheel, Q, in front, which is fixed on the upright shaft, R, and turns the two bevil pinions, S. By these again the shaft, T, is moved, with its small pinion, U, which, working into a rack on the segment of a circle on the fore carriage, give full power to place the two axles at any angle necessary for causing the carriage to turn on the road, the centre of motion being the perch pin. To the fore naves are fixed two cylindrical metal rings, round which are two friction-bands, to be tightened by a lever convenient for the foot of the conductor, and which will readily retard or stop the coach when descending hills.

In addition to the above, we extract the following from the account which appeared in the Scotsman—an account which we have reason to know the inventor considers as extremely distinct and accurate.

"The engine, as in all the English

loco-motive machines, is on the high pressure principle. Its power is of course variable; but with a free pressure of 15 pounds, it would be of 3 *computed* horse power, which would be equal to the efficient force of seven or eight horses running at eight miles an hour. This will probably be sufficient to give the steam-coach the usual velocity of stage-coaches. But where the supply of fuel and water constitutes so considerable a part of the burden of the vehicle, economy in the use of these articles is of the first importance. Accordingly, it forms part of the engineer's plan, to let more or less water into the boiler as a greater or less force may be required. In going down a declivity, for instance, the steam will be entirely saved, and, in going up, an extra quantity will be used. The large wheels, we think, are about 4½ feet in diameter, or 14 in circumference. Supposing the engine to make 50 double strokes per minute, this would give the machine a velocity of 8 miles an hour. If the experiment succeed, the expense of fuel and attendance for an engine like this will be such a mere trifle, compared with the keep of 16 horses, that the cost of travelling per coach to Glasgow, which is now about 4d. per mile, may certainly be reduced two-thirds.

ON CATERPILLARS.

It is certainly at all times gratifying to observe in any person a desire to investigate the wonders of nature, however low in the scale of created beings the subject of observation may rank; and however contemptible it may appear to untutored minds. I am very far, therefore, from withholding from the writer of the article which appeared in Number XCIV., entitled "Caterpillars," and signed "Curiosus," the due credit for his curiosity in these matters; but it is to be regretted that he has been so premature in divulging his fancied newly discovered theory of animal reproduction, without awaiting the final result of the phenomenon he has witnessed, which he has not done. The day has long gone by, when such theories of spontaneous production were received as truths; and the age we live in is too enlightened to credit accounts of a second Phœnix.

To put Curiosus, who is evidently no naturalist, and such of your numerous readers as may have been misled by him, to rights on this subject, it may be laid down as a universal law of nature, that all caterpillars (larvæ) are "invariably" produced *from eggs*, which have been deposited by the parent insect, when in its last, or perfect state (imago;) in which state alone it is capable of perpetuating its species. The species alluded to by Curiosus, is no exception to the general rule: it is the caterpillar of the beautiful large cabbage butterfly, (papilio brassicæ,) whose flutterings adorn a summer's day; and if Curiosus will be at the pains to collect a small number of these caterpillars, and keep them in a dry glass vessel till the spring, he will have the pleasure of seeing them burst from their prisons in all their beauty.

What Curiosus has observed, regarding this caterpillar, is, however, of common occurrence with all caterpillars; but he has fallen into an egregious error in endeavouring to account for the circumstance, solely through his ignorance of the subject. For the reason immediately to be given, *every caterpillar does not arrive at the perfect state.* Wonderful as the appearance is which Curiosus has noticed, I will venture to affirm, that, should he carefully preserve the "little clusters covered with yellow down" till the vivifying influence of spring calls them into exertion, his astonishment will be tenfold when, instead of them producing young caterpillars, as he imagines, he will observe to issue from each individual of the cluster a little active, sprightly, predatory, and perfect insect, with four wings, totally unlike a caterpillar, whose beneficial services in the economy of nature he has seen exemplified in the destruction of the caterpillar he speaks of. It is known to every person in the least versant in Entomology, that there is an extensive family of insects, classed under the Linnean order, Hymenoptera—the genus Ichneumon, of which genus it is supposed we have at least 800 species in Britain. The whole of these species subsist during the larva state within the bodies of other insects, and chiefly within those of the caterpillars, of butterflies, and moths; and but few insects, not even excepting the spider, can be said to be exempt from their attacks. It is worthy of remark, that each species of insect is infected by its own particular species of Ichneumon, so that in proportion to the number of species of caterpillars, &c. so are the Ichneumons. The female Ichneumon is provided with a pointed instrument or sting, with which she pierces the unfortunate caterpillar, and into every puncture deposits an egg, which in process of time produces a minute, active, larva, which immediately penetrates the body of the insect on which it was deposited, and there continues to feed upon its less vital parts. The caterpillar in the meantime loses none of its powers: it eats and grows, and externally bears no marks, indicative of the incessant internal gnawings it is destined to suffer. However, it never comes to maturity; for the Ichneumon, true to its nature, continues to devour it, and increases in size, till its appointed time, when it worms its way through the sides of the caterpillar, and shuts itself up in a silken cocoon (pupa;) and after a certain period, which varies according to the species, it issues forth a winged insect, armed, and ready to perpetuate the same persecutions on the sluggish caterpillar, which its parent had done before it, in providing for a future progeny.

After this explanation, it need not be added that the little maggots which Curiosus saw "exude" from the sides of the caterpillar, and which he supposed to be its young, were no other than the larvæ of the Ichneumon.

To estimate the advantages derived by the agriculturalist, and the horticulturalist, from the wonderful instinct with which these little insects are endowed, it need only be told, that of the myriads of caterpillars which are annually produced, it is supposed that at least two-thirds of the number fall victims to the Ichneumon; and but for their unconscious exertions, the caterpillar race would so multiply, that no vegetable would outlive their ravages; and we would have the dreary prospect presented to us, so frequently exhibited in eastern countries by the devastations of the locust.

It would have been much better for Curiosus to have contented himself with stating the fact as he observed it, and his suppositions in the form of a query; and it is really too much to see him in farther accounting for it, to find a new use for the stigmata of an insect. These have been long ascertained to be the lungs of the animal, and are common to insects in all their stages. For information on the subject, I would refer Curiosus to the anatomy of the caterpillar, by the celebrated Lyomet, where he will find their use and functions explained. I conclude by assuring Curiosus, that should he extend his researches among the insect tribes, he will find ample scope for the gratification of his curiosity; and every day's research will furnish him with new matter of astonishment.

An Entomologist.

ON THE GOLD MINES OF NORTH CAROLINA.

By Denison Olmsted, Professor of Chemistry and Mineralogy in the University of North Carolina.

[Continued from p. 136 of the present Volume.]

At Concord, near the western limit of the gold country, the metal is found in small grains in the streets and gullies after every rain; and the gullies frequently disclose the stratum of gravel and mud, well known as the repository of the gold. Washings, on a more limited scale, are conducted here. The clay is not so dense at this place as at Reed's Mine, but more ferruginous and full of spangles of golden-coloured mica. This stratum rests on gneiss; those before described were over the slate formation.

Parker's Mine is situated on a small stream four miles south of the river Yadkin. As in the instances already mentioned, excavations were numerous in the low grounds adjacent to the stream; but, at the time of my visit, the earth for washing, (which was of a snuff colour,) was transported from a ploughed field in the neighbourhood, that was elevated about fifty or sixty feet above the stream. The earth at this place, which contained the gold, was of a deeper red than that at either of the other mines. The gold found here is chiefly in flakes and grains. Occasionally, however, pieces are met with which weigh 100 dwts. and upwards; and very recently a mass has been discovered that weighed four pounds and eleven ounces. This is said to have been found at the depth of ten feet, which is a lower level than any I had heard of before. The idea of an aqueous deposit, which is apt to be impressed upon us whenever we either inspect the formation, or reflect upon its origin, would lead us to expect, on account of the great specific gravity of gold, that the largest masses would be found at the lowest depths. But I am not aware that any uniformity exists in this respect. The largest mass hitherto discovered was, as has been mentioned already, found within a few inches of the surface. It is evident that the thin stratum which contains the metal, will be buried at different depths, by variable quantities of alluvial earth, that are accumulated over it by causes still in operation; and, consequently, that the depth at which the stratum happens to be met with, in any given place, is no criterion of its richness. Nor does the fact that this fortunate discovery was made at a lower level than ordinary, afford any encouragement to work lower than the usual depth. It might interest geological curiosity, however, to learn the nature of the strata below the gold deposit, although I do not know that the existence of this furnishes any reasonable grounds for supposing that there are other similar deposits below it. I could not find that any search had been made with such an expectation, except in a single instance. Near the spot where the largest mass was found, the earth was penetrated a few feet below the gold bed. Immediately beneath this was a thin layer of green sand, and next a similar layer of a bright yellow sand. These had a very handsome appearance, but neither of them seemed to contain any thing more precious than mica.

The *terms* on which the proprietors of the mines permit them to be worked, vary with the productiveness of the earth which is worked. Some of the miners rent for a *fourth* of the gold found; some for a third, and others claim half, which is the highest premium hitherto paid. The average product at Reed's mine was not more than sixty cents a day to each labourer; but the undertakers are buoyed up with the hope of some splendid discovery like those which have occasionally been made.

The mines have given some peculiarities to the state of society in the neighbouring country. The precious metal is a most favourite acquisition, and constitutes the common currency. Almost every man carries about with him a goose quill or two of it, and a small pair of scales in a box like a spectacle case. The value, as in patriarchal times, is ascertained by weight, which, from the dexterity acquired by practice, is a less troublesome mode of counting money than one would imagine. I saw a pint of whisky paid for by weighing off three and a half grains of gold.

The greatest part of the gold collected at these mines is bought up by the country merchants at 90 or 91 cents a pennyweight. They carry it to the market towns, as Fayetteville, Cheraw, Charleston, and New York. Much of this is bought by jewellers; some remains in the banks; and a considerable quantity has been received at the mint of the United States. Hence it is not easy to ascertain the precise amount which the mines have afforded. The value of that portion received at the mint before the year 1820, was 43,689 dollars. It is alloyed with a small portion of silver and copper, but is still purer than standard gold, being 23 carats fine. (Bruce, *Mineral. Jour.* I. 125.)

It will probably appear evident to geologists, from the foregoing statements, that the gold of North Carolina occurs in a *diluvial* formation. Such, indeed, seems to be its usual bed; and, in this respect, it resembles the gold countries of South America, of England, of Scotland, of Ireland, and of Africa. (Buckland, *Rel. Diluv.* 218—20.)

Our author next proceeds to the discussion of two questions connected with this subject:

1*st.* Is the gold brought down from the sources of the rivers? And,

2*d.* Did the present lumps and grains ever form parts of large masses in a continued bed or vein?

The first of these questions Professor Olmsted answers in the negative; but he considers it as evident that the rivers cut through a stratum containing the gold, which covers like a mantle an extensive part of the country through which they flow, and that they bring the precious metal to view by separating it from its stony matrix.

On the subject of the second

question, Professor Olmsted concludes, that this gold existed originally, that is, before its removal to its present position, in pieces somewhat larger than those found at present, but still of a moderate size; but he considers it is impossible to decide whether those pieces lay contiguous to one another in a large vein, or whether they were scattered abroad in individual masses.

ON CHOLERA MORBUS.

The frequency and severity of cholera morbus at this season, induces us to make a few observations on it. It is a disease to which many of the mechanical professions are extremely liable. The lower extremities of the workmen are often exposed to draughts or currents of air, whilst they are exceedingly inattentive to those articles of cloathing by which their feet and legs are kept comfortable and warm. Now there cannot be a more frequent source of disease in the bowels and lungs, bringing with them their fearful train of suffering, and often ending in death, than inattention to the circumstances to which we have alluded. The proper precautions ought, therefore, to be immediately adopted, and are of the very highest consequence to those who have irritation in the bowels, indicated by looseness and indigestion. Keeping the lower extremities and belly warm, are, as we have said, of vital importance, and, indeed, we have known the disease entirely removed by simply swathing the belly with flannel, wearing comfortable stockings, and shoes sufficient to exclude the damp. When the bowels are thus irritated, the food should be light and simple, such as sago, rice and milk, flour porridge, &c.

Medicines are in general, however, necessary; and on the faith of one who has found its administration, in cases of cholera, followed by the happiest effects, we would recommend the compound powder of chalk and opium, prepared according to the formula of the London Pharmacopeia, as *a remedy of expeditious and almost certain efficacy.* The medicine we recommend may be thus made up: prepared chalk, two scruples; powdered opium, one grain; aromatic powder, six grains. These must of course be well mixed together in a mortar, but this will be done by the druggist from whom it is obtained, and it will likewise be necessary to cause him to weigh it out into dozes, and put them up in separate papers. The doze is a scruple, and it may be taken in a little water, to which a small portion of sugar, treacle, or syrup may be added, to render it more palatable. This is to be repeated four or five times during the twenty-four hours.

If the severe and protracted nature of the disease should resist the soothing influences of the compound powder of chalk and opium, the addition of ten grains of the compound powder of kino to each doze, with fomentations to the abdomen, the free use of bland and demulcent drink, such as water-gruel, barley-water, or a portion of gum dissolved in water and sweetened to taste, rigid abstinence from spirituous or malt liquors, &c. will not fail to remove all those symptoms of cholera which it would be prudent to trust to other than professional assistance.

HARDING'S STENOGRAPHY.*

This is a very clear, concise, and, what is most important, cheap system of Stenography. It combines numerous improvements from different writers; but is founded on the system of Mr. Taylor. The rules given are well qualified for instructing those who, not having the opportunity of attending a teacher, are obliged to instruct themselves; and we think, that any person of ordinary capacity, carefully attending to the rules here laid down, and practising for an hour or two each day for a few months, will have a complete command of the whole system. The principal difficulty is in the combination of the letters; and, in order to facilitate this difficulty, we have here a table of the various combinations of two letters which the English language admits of. We can for these reasons, therefore, safely recommend to our readers this little work, which is neatly printed, and illustrated with distinct well-executed engravings.

DR. BLACK'S SENSIBLE BALANCE.

The following description of a very delicate, and to many it may be very useful, balance, is taken from a letter written by Dr. Black to James Smithson, Esq., and inserted in the Annals of Philosophy, N. S. Vol. X. p. 52:

"The apparatus I use for weighing small globules of metals, or the like, is as follows: A thin piece of fir-wood, not thicker than a shilling, and a foot long, 3-10ths of an inch broad at the middle, and 1½-10ths at each end, is divided by transverse lines into twenty parts; *i. e.* ten parts on each side of the middle. These are the principal divisions, and each of them is subdivided into halves and quarters. Across the middle is fixed the smallest needle I could procure, to serve as an axis, and it is fixed in its place by means of a little sealing-wax. The numerations of the divisions is from the middle to each end of the beam. The fulcrum is a bit of plate brass, the middle of which lies flat on my table when I use the balance, and the two ends are bent up to a right angle, so as to stand upright. These two ends are ground at the same time on a flat hone, that the extreme surface of them may be in the same plane; and their distance is such that the needle, when laid across them, rests on them at a small distance from the sides of the beam. They rise above the surface of the table only one and a half, or two-tenths of an inch, so that the beam is very limited in its play.

"The weights I use are one globule of gold, which weighs one grain, and two or three others which weigh one-tenth of a grain each; and also a number of small rings of fine brass wire, made in the manner first mentioned by M. Lewis, by appending a weight to the wire, and coiling it with the tension of that weight round a thicker brass wire in a close spiral, after which, the extremity of the spiral being tied hard with waxed thread, I put the covered wire in a vice, and applying a sharp knife, which is struck with a hammer, I cut through a great number of the coils at one stroke, and find them as exactly equal to one another as can be desired. Those I use happen to be the one-thirtieth part of a grain each, or 300 of them weigh ten grains, but I have others much lighter.

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* Universal Stenography. By William Harding. London, Knight & Lacey; Glasgow, W. R. M'Phun.

"You will perceive that by means of these weights, placed on different parts of the beam, I can learn the weight of any little mass, from one grain, or a little more, to the $\frac{1}{1200}$ part of a grain. For if the thing to be weighed, weighs one grain, it will, when placed on one extremity of the beam, counterpoise the large gold weight at the other extremity. If it weighs half a grain, it will counterpoise the heavy gold weight at five; if it weighs 6-10ths of a grain, you must place the heavy gold weight at five, and one of the lighter ones at the extremity to counterpoise it; and if it weighs only 1 or 2 or 3 or 4-100ths of a grain, it will be counterpoised by one of the very small gold weights placed at the first or second or third or fourth division. If on the contrary, it weigh one grain and a fraction, it will be counterpoised by the heavy gold weight at the extremity, and one or more of the lighter ones placed on some other part of the beam.

"This beam has served me hitherto for every purpose, but had I occasion for a more delicate one, I could make it easily by taking a much thinner and lighter slip of wood, and grinding the needle to give it an edge. It would also be easy to make it carry small scales of paper for particular purposes."

Mr. Smithson observes that the rings or small weights mentioned above have the defect of their weight being entirely accidental, and consequently most times vary inconvenient fractions of grains, and recommends instead, that the weight of a certain length of wire be ascertained, and then the length of it taken, which corresponds to the weight wanted; when fine wire is used, a set of small weights may thus be made with great accuracy and ease. This is a process the value of which is well known to the philosophical instrument-maker.

FLEXIBLE MARBLE OF BERKSHIRE, UNITED STATES.

Dr. Davey states that this marble, which has been known for some years, and until lately was found chiefly in West Stockbridge and Lanesburgh, is now obtained at New Ashford from an extensively wrought quarry. He had three fine specimens of it in slabs, from five to six feet in length, and seven inches in width. Its flexibility and elasticity may be shown as it stands upon one end, by applying a moderate force to the middle or the other end. Its flexibility is seen too by supporting the ends of it in a horizontal position upon blocks. The marble has various colours nearly white, with a reddish tinge, gray, and dove coloured. Some of it has a fine grain; other specimens are coarsely granular, and have a loose texture. It is not uncommon for one side of a large block to be flexible, while the other part is destitute of this property. It takes a good polish, and appears to be carbonate of lime, and not a magnesian carbonate.

It is well known that Dolomieu attributed the flexibility of the marble he examined to exsiccation, and that Bellevue ascertained that unelastic marble might be made elastic by exsiccation. The flexible marble of this country, however, loses this property in part on becoming dry. When it is made thoroughly wet by the operation of sawing or of polishing, it must be handled with great care, to prevent its breaking; and the large slabs of it cannot be raised with safety, unless supported in the middle as well as at the ends.—*Silliman's Journal,* IX. 241.

ON THE HABITS OF BEAVERS.

By M. Geoffrey St. Hilaire.

A beaver has lived in the menagerie of the King's garden for some years: it is one of those from the Rhone, which live separately like water-rats. This animal was defended from the cold of winter only by a more abundant litter. It happened one night that the cold had increased; the shutters of the hut closed but badly, and the beaver was urged to find means of preserving itself from the effects of a very rigorous temperature. It had been the custom to give it a certain number of fresh branches to satisfy its desire of gnawing, and occupy it during the night; these were found stripped of the bark in the morning: food also was given it, consisting of greens and fruits of an evening, before shutting it up by closing the shutter, which was made like a pent-house. It had snowed through, and the snow had collected in one corner of its hut.

Such were the materials which the beaver in this instance possessed to form a wall of defence against the external air and cold; the branches were interwoven between the bars of the hut, exactly in the way that basket-makers interweave the small osiers round the principal stems, going from one to another by contrary turns. Thus arranged, they left intervals, in which the beaver placed the carrots, potatoes, and litter which remained, each substance being cut so as to occupy and fill the spaces left. Finally, as if the animal knew that the whole should be covered with a compact cement, he employed the snow to fill up even the smallest aperture which remained. The wall filled up two-thirds of the gap, and every thing which had been given to the animal, even the whole of its food, was employed in the construction.

In the morning, the snow having frozen between the branches and the shutter, the latter adhered to this new wall: when removed, however, the work of the beaver became exposed. The boy who attended to the animal was so surprised at this unexpected production, that he came and informed me of it before any thing was deranged.—*Mem. de Mus.* XII. 232.

ON THE LENGTH OF THE ELECTRIC FLASH PRODUCING LIGHTNING.

By M. Guy Lussac.

The length of the flash during storms is always very great; and one may readily ascertain, in a mountainous country, that it frequently exceeds a league. This extraordinary length, and the awful sound produced by the flash, induces us naturally to admit, that the quantity of electricity which forms it is incomparably greater than that which may be accumulated in the largest electric batteries. We cannot produce explosion except at the distance of a few centimetres, (an inch or two,) and the intensity which we must suppose is required in batteries, to make an explosion at the distance of a few metres, (or a few yards,) only would be so great as to make it impossible it could be retained on a cold surface, by the pressure of the air. On the other side, when lightning falls on a lightning-rod, it frequently happens that only a small portion of the point, perhaps three or four millimetres (0.12 to 0.16 of an inch) is fused; and this effect is not very different to what may be produced by large electrical batteries.

But we cannot really judge of the intensity of electricity accumulated in our conductors, and on a thunder-cloud by the length of the spark. The electricity is retained on our conductors by the pressure of the air, the spark only occurs when this pressure can be overcome by the electricity. On the contrary, the electricity is retained on a cloud only by the resistance it affords to it as a non-conducting body; and equally pressed as it is by this fluid which surrounds it on all sides, it should obey the slightest attraction or repulsive forces by which it is affected. We may therefore conceive, that as soon as the electricity has formed a stratum, no matter how attenuated, so that it be continuous, the flash may occur, and pass through considerable distances. The intensity of the flash will be produced by the quantity of electricity contained in the immense stratum enveloping the cloud. If the stratum is not continuous, which is very possible in so bad a conductor as a cloud, or if all the electricity spread over the space occupied by the cloud has not had time to disengage itself so as to arrive at the surface of the cloud, the discharge will only be partial, and then the redoubled peals of thunder will easily be understood. It appears impossible to us, according to these observations, that the thickness of the electric stratum can ever be any thing like so great on the surface of a thunder-cloud, as on that of a solid conductor; for the repulsion of its molecules would dissipate it in the air. We perceive nothing to retain it but the resistance of the air as a non-conductor, and that resistance can be but very small.

As the primitive electricity spread over the space occupied by a thunder-cloud can unite but very slowly into a thin stratum, it becomes difficult, according to the theory of Volta, to attribute to it the formation of hail in particles as large as those which are sometimes observed. The phenomenon, however, is certainly connected with atmospheric electricity; and though we are not acquainted with all the circumstances which would enable us to comprehend it, we must not reject a cause because it appears to us not to have an intensity proportional to the effects we would explain.—*Ann. de Chim.* XXIX. 105.

MISCELLANIES.

Menstruum for Biting in on Steel Plates for Fine Engravings. By Mr. Edmund Turrell.—This useful process, for which Mr. Turrell has received the large gold medal of the London Society of Arts, has been the result of a great number of well-directed experiments, made for the purpose of discovering a menstruum which should corrode the steel with great facility, while it produced a beautiful, clear, and deep line. The following is the compound fluid which he found the most perfect.

Take four parts, by measure, of the strongest pyroligneous, (chemically called *acetic acid,*) and one part of alcohol or highly rectified spirits of wine; mix these together and agitate them gently for about half a minute, then add one part of pure nitric acid; and when the whole are thoroughly mixed, the menstruum is fit to be poured upon the etched steel plate.

This fluid holds the oxide of the metal in perfect solution, so that the whole of the lines appear beautifully bright, and continue so till the biting in is completed. Very light tints are corroded in about one minute and a half, and a considerable degree of colour is produced in about fifteen minutes. When this mixture is poured off the plate, it should be washed with one part of alcohol, and four of water, and the stopping out should be effected by asphaltus dissolved in essential oil of turpentine, so as to flow freely from a hair pencil. In making the above menstruum, the purity of the ingredients is a matter of great importance.

The steel plates used for engraving may be saved from rust by warming the plate and rubbing sheep's suet (from the animal) over it, and keeping it near a fire or in a dry room. The best steel plates are those manufactured by Mr. Rhodes and Mr. Hoole of Sheffield. See the *Transactions of the Society of Arts*, 1824, vol. XLII. p. 50.

A coarse Paint made with Potatoes.—Take a pound of potatoes, skinned and well baked; bruise them in three or four pounds of boiling water, and then pass them through a hair sieve. To this add two pounds of good chalk in fine powder, previously mixed up with four pounds of water, and stir the whole together. This mixture will form a sort of glue capable of receiving any kind of colour, even that of powdered charcoal, brick, or soot, which may be used for painting gates, palings, and other articles exposed to the air.

On the Construction of Chimneys.—Mr. Tredgold, in his work on warming and ventilating apartments, has given the following rule for proportioning the upper orifices of chimneys to their heights and the magnitude of the fire-places:—

Multiply by 17 the length of the fire-place in inches. Divide the product by the square root of the height in feet, and the chimney above the fire. The quotient will be the area of the upper orifice in square inches.

Thus, if the fire is 15 inches wide, and the height of the chimney be 9 feet, we shall have $\frac{17 \times 15}{7} = 36\frac{1}{2}$ square inches nearly, which is a rectangle of 6 × 6 inches, in a circle of nearly 7 inches diameter. In chimneys already existing, the upper orifices may be contracted to their proper size by Parker's cement. The contraction of the lower end of the vent, above the fire, should be nearly the same as the upper orifice; and the throat, or lowest opening, should not exceed the length of the bars. The length of the front of the fire should be an inch for every foot of the room's length, and the depth one half the length. If the length of the chamber should be such as to require a grate more than 30 inches long, two fire-places should be constructed.

M. Ventau's Gigantic Meteorological Æolian Harp.—Captain Haas of Basle has designated, by these names, an apparatus which emits of itself a variety of sounds during a change of weather. Since the year 1787, he had stretched above his garden *fifteen* iron wires, 320 feet long, and at the distance of about two inches from one another; the largest wire two lines in diameter, the smallest one line, and those of intermediate size one and a half line. They were situated towards the south, and are inclined 20° or 30° to the horizon, being stretched by means of rollers properly arranged for the purpose. Whenever the weather changes, these wires sound with such loudness, that it is impossible to go on with a concert in the house. The sounds sometimes resembled the hissing noise of water rapid in ebullition, sometimes that of a harmonicon, and sometimes that of a distant chime, or an organ.

The inventor of this curious apparatus is M. Ventau, provost at Burkli, not far from Basle. He sometimes shot at a mark from his window; and in order that he might not go to the mark after each shot, he attached to it a long iron wire to draw it to him at pleasure. He remarked more than once, that that wire sounded exactly an octave; and he found that every iron wire, stretched in a direction parallel to the sounds, emitted this tone at every change of weather.

A brass wire did not produce any sound, nor did an iron wire, when it was stretched from east to west.

M. Dobereiner of Jena, conceives that the phenomena now described is the effect of an electro-magnetic action, and he proposes to try if the brass wire would not sound when it communicates at its extremity with an energetic electrometer.—*Bullet. des Sc. Techn.* &c. July, 1824, p. 51.

Natural Lamp by Incandescence.—In using a spirit of wine lamp, M. Dobereiner observed, that when the spirit of wine was nearly consumed, the wick became carbonised, and that the flame disappeared, yet the carbonised part of the wick became incandescent, and continued red while a drop of alcohol remained, provided the air in the apartment was tranquil. In one experiment it continued red twenty-four hours; a disagreeable acid vapour, however, was formed.

Dr. Brewster long ago observed an analogous fact in the small green wax tapers in common use. When the flame is blown out, the wick will continue red for many hours, and the wax and the wick are burned down as in its ordinary combustion, only with extreme slowness; a very disagreeable vapour being formed during the imperfect combustion. Dr. Brewster has observed also, that the same effect is not produced when the taper is made of *red wax*. This probably arises from the colouring matter of the two tapers. There can be little doubt, however, that the same result will be obtained with different kinds of wax, and even with tallow, provided the quantity of wax is properly proportioned to the diameter of the wick.

Oil for Chronometers, Clocks, and delicate Wheel-work.—It has long been a desideratum among watchmakers to procure good oil, that retained its fluidity for a length of time, without acting upon the metals which it lubricated, and without becoming thick or freezing with cold. For this purpose, every kind of acid or of mucilage must be taken from it. In short, it should by pure *elaine*, without any trace of stearine.

In order to extract the elaine from fixed oils, M. Chevreul treats it in a matrass, with seven or eight times its weight of alcohol nearly boiling, decanting the liquid and exposing it to the cold. The stearine will then separate in the form of a crystallised precipitate. The alcoholic solution must then be evaporated to the fifth of its volume, and the remainder will be elaine, which ought to be colourless, insipid, almost without smell, without any action on the infusion of turnsole, having the consistence of white olive oil, and coagulable with difficulty. M. Peclet's method of procuring elaine, consists in pouring upon oil a concentrated solution of caustic soda, stirring the mixture, heating it slightly to separate the elaine from the soap of the stearine, pouring it on a cloth, and then separating by decantation the elaine from the excess of alkaline solution. Some excellent observations on the effects of oil in jewelled holes, &c. will be found in the Edinburgh Encyclopedia, Art. Horology, vol. XI. p. 137.

Remarkable Hailstones with pyritic Nuclei.—The following very curious account of these hailstones is given in a letter from Professor John of Berlin, to Baron Ferrussac. It forms also a part of a letter from Dr. Eversmann, known by his travels in Asia, dated 16th September, from Orenburg, where he has landed property.

"Some days before our arrival at Sterlitamack, (more than 100 versts from Orenburg,) there arose a storm in which very remarkable hail fell. *The hailstones, which were tolerably large, contained a stony and crystallised nucleus.* Thirty of them have been sent to our Governor, and I have received two specimens." They are of a brown colour, like the auriferous pyrites of Beresowsky, in Siberia. Their surface is shrivelled and shining. The crystal forms a flattened octohedron, whose edges are salient. The two diagonals of the base are five lines by four, and the distance of the summits is two lines. Sometimes the four angles of the base are truncated. It seems that the constituent parts of these crystals are sulphur and metals. No analysis of them has yet been made, but I shall perhaps have occasion to do this.—See *Bull. des Sc. Phys.* Feb. 1825, p. 117.

Recent vegetation of Ancient Beans.—As I happened to be at Naples, when first Herculaneum was discovered, I should have told you that some leathern bags of beans, answering exactly to our kidney ones, were found in several corners of their window seats. The Romans were very fond of that kind of supper, as appears by a line of Horace:

> "Oh quando faba Pathagoræ," &c.

Some English gentlemen were curious enough to sow them on their return; and notwithstanding their having been to appearance dead for so many centuries, yet did they grow and produce. Dr. Lawson tried the experiment in a small garden of his at Chelsea, and succeeded.—*Monthly Mag.* IX. 98.

Globules of Water in Amethyst.—Mr. Webb of Providence, U. S. has had occasion to observe that globules of water and air were by no means unfrequent in specimens of amethyst, which came under his eye. Many of them were highly interesting, from the size of the globule or portion of liquid, the form of the cavity containing it, the exhibition of double refraction through the crystal which it afforded, &c. He remarks that most of these specimens were found among such as had been rejected on account of being too pale for good cabinet specimens, and thinks it probable that good specimens are continually neglected for want of sufficient and close examination.—*Silliman's Journal*, IX. 246.

Meteoric appearance on Ben-Lomond and Loch-Lomond.—" On Sunday, May 8th, I set out, accompanied by my friend Mr. Savage, at three o'clock in the morning, to ascend Ben-Lomond, and, if possible, arrive at its summit before sunrise. The morning was unfavourable; the wind, blowing from the south-west, was cold and damp; the sky on that quarter was every where covered with dark and dense clouds, which seemed crowding towards the towering summits of the surrounding hills, leaving the Isles of Arran and Bute, the mouth of the Clyde, and Loch-Lomond, in dreary and dismal darkness. Towards the east, a small extent of deep-azured sky was to be seen; but even there, a number of cumuli and cirri were rapidly forming, and numerous variously shaped white-edged cumuli strata, and more dense nimbi. A short time after this, it began raining, and continued incessantly for the space of nearly two hours; during which time we sheltered ourselves principally under the rugged cliffs of mica slate, of which the summit of this celebrated mountain is composed. Taking advantage of the first interval of fine weather, we again attempted to ascend the steep sides, and gain the wished-for top. The clouds soon broke, and allowed the sun to dazzle forth in all its splendour, upon the steep, though romantic, declivity beneath our feet. It was about this time, having our faces turned towards the west, that we observed streams of vapour rise from the earth, in two or three places, (at about a mile distant from us, and 400 or 500 yards apart from one another,) and ascend in a perfectly straight direction towards a heavy dark nimbus passing over at the time. Using my hat as a level, I lay down on the ground, and found it to be rather lower than the situation I occupied near the summit of the mountain. Their bases were, I should suppose, not above three or four feet in diameter, which did not increase nor diminish till their junction with the cloud, when they assumed a more conical shape, the base of which was in the cloud; they resembled immense columns or pillars; they had no motion forwards or backwards; and, as far as our eyes could ascertain, they had no revolving motion upon their own axes. The attraction existing between the pillar and the cloud was so great, that, at the supervention of a strong breeze, though the centre of the pillar yielded, it never deviated from its columnar form, and the top remained precisely over the point from which it arose, forming, as it were, for the time, a segment of a circle. A short time after perceiving this remarkable phenomenon, we had occasion to remark the same process taking place on the lake itself. The columns, though at a great distance from us, we could plainly perceive were vapour, and not water; but they did not take on themselves so uniform an appearance. During this interesting scene, I hung two small balls hewn out of the pith of the elder-tree, at the end of a stick of gum-lac, a strong insulating substance, and more portable than glass; the repulsion from one another was such, as to indicate that the atmosphere was in a high state of electricity. Hygrometer I had none; thermometer stood at 45°."—*Mr. W. T. Ainsworth.*

NOTICES TO CORRESPONDENTS

The account of Dr. Bryce's Stomach Syphon will appear in the course of a week or two. We have received Mr. W. Ballantyne's (Water of Leith) communication. We will be obliged to get new drawings executed, as those sent are too indistinct to go into the hands of our Engraver. His article shall appear as soon as this is done. We have received a letter from Mr. R. W., Dunbar, but not the parcel he alludes to. This, however, we hope to receive shortly. He and his friends did well to send it here, because it will probably reach the eye of the individual he alludes to sooner through our medium than any other.

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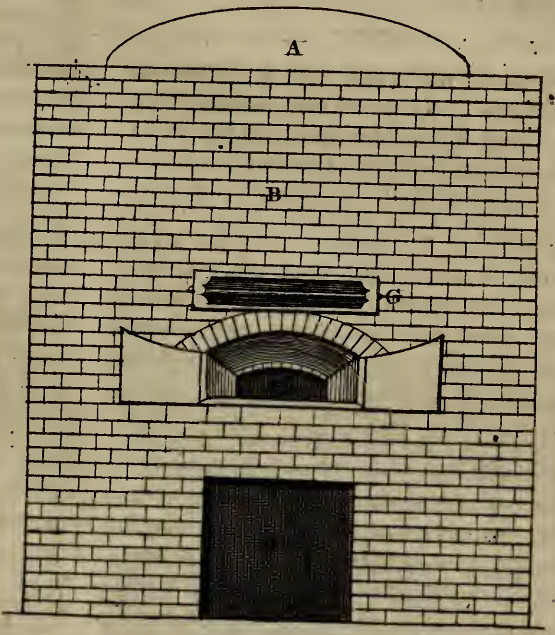
A Committee of Civil Engineers and Practical Mechanics.

> "Liberal, not lavish, is kind Nature's hand;
> Nor was perfection made for man below:
> Yet all her schemes with nicest art are plann'd,
> Good counteracting ill, and gladness woe."

No. XCVII. *Saturday, 29th October,* 1825. Price 3*d.*

MR. ROBERTON'S PLAN FOR CONSUMING SMOKE; DR. BRYCE'S STOMACH SYRINGE.

Fig. 1.



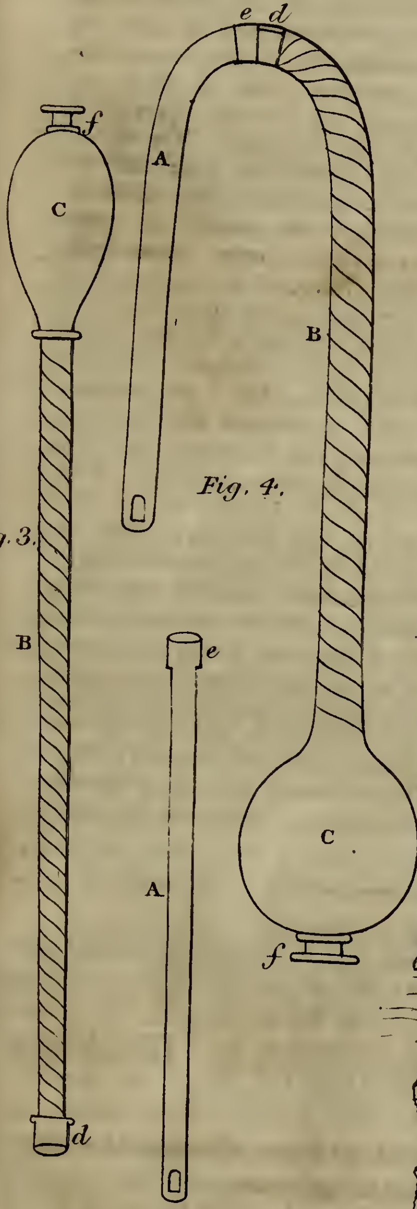
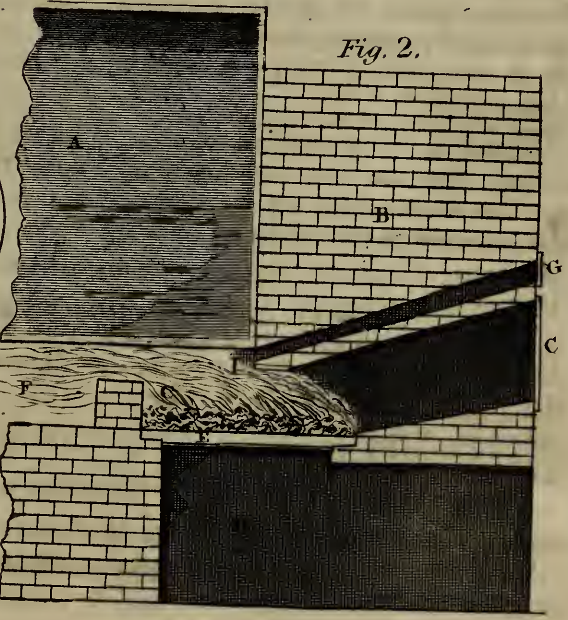


Fig. 2.



— Swan Sc —

PLAN FOR BURNING SMOKE.

By Mr. John Roberton, Founder, Gorbals, Glasgow.

[Notwithstanding the evident advantage which the public would derive, the success which has followed the adoption of this improvement in Manchester and some other places, and the saving of fuel which is obtained, we are not a little surprised to perceive that so few of the proprietors of public works have made the smallest exertions for burning their smoke, or seem to care any thing about the matter. It is quite needless to enlarge upon the advantages which the public would receive, were the consumption of smoke to become general, as every one seems convinced of this; we believe it is equally useless to urge the saving of fuel, as very few, we should think, after the evidence which has been afforded by Manchester, ought to doubt on this head; and we must say we are at a loss to comprehend the cause of the apathy which seems to prevail on this subject, as the inhabitants of Glasgow are not generally behind hand where either private or public advantage is likely to be obtained. We had thought the pamphlet of Bailie Clelland, and our former article, would have done some good, but we are still disappointed.

Having learnt that our friend Mr. Roberton had a very simple and ingenious plan in operation at his foundry in the Gorbals, we went over lately for the purpose of seeing it and observing its effects. Mr. Roberton we found extremely attentive, and he did every thing in his power to point out to us the advantages and efficacy of his plan, and also the objections which had occurred to him in practice, and the modes he had taken to remedy them. In order to show its operations, Mr. Roberton caused his fireman to throw on a very large quantity of coals and dross, far above what is customary or necessary, so that an additional quantity of smoke was produced, and the door of the air-plate was shut. Immediately after, large volumes of thick black smoke appeared at the top of the chimney stalk, but on opening the door of the air-plate, in an instant or two, the black smoke disappeared, and a thin light grey vapour was all that made its appearance. This was several times repeated; and we feel quite convinced that Mr. Roberton's plan, the apparatus for which can be put up at almost no expense, is as complete as many of those which are much more complicated and expensive. In the hope that some of the proprietors of public works, in and about the city, will try this plan, we have obtained from Mr. Roberton the following account of his method, with the accompanying drawings.]

Gentlemen,—Having perceived in your Magazine an account of a plan for burning smoke, by Mr. Chapman, I beg to send you a plan which has been for some time in operation with me, and which I certainly think much simpler and equally efficacious with any which I have seen. The accompanying drawing and a very short explanation will make this method perfectly clear.

Fig. 1 is a front view of the furnace and boiler; fig. 2 is a section. A, is the boiler, and B, the brickwork in front of it. This building is made half the length of the furnace bars deeper than usual, in order that the air-plate, to be afterwards mentioned, may be properly admitted. C, (in both figs.) is the furnace; D, the ash pit; E, the bars on which the fire is placed; and F, the flues beneath and surrounding the boiler. All this, with the exception of the situation of the boiler, is much the same as usual. The plan for burning the smoke is this: An opening, G, is made immediately above the mouth of the fire-place, with a passage, H, sloping down to it, and joining it, just beneath the end of the boiler, thus opening in upon the middle of the furnace, and just over the reddest and most inflamed part of the fire. This opening has a door upon its mouth, which, turning upon a swivel, allows of its being open or shut as may be wished; this passage being lined both above and below with plate iron, from which I have called it the air-plate. When it is desired to burn the smoke, the door is kept open, and a current of air thus rushes down through the air-plate upon the smoke arising from the green part of the fire, which is thus, as it passes over the red flame, blown down upon the fire, by which it is immediately ignited, and passes off through the flue, F, in a body of flame. Since I have used it, I have found that by this method the smoke is completely burned, and nothing escapes from the top of the chimney but a little light grey smoke, instead of the dense black volumes which make their appearance when the door over the mouth of the passage, H, is shut, and the plan not in operation. I have never observed that this plan, or the boiler being placed partly from under the fire, in the smallest degree retards the making of steam, as the flame commences immediately at the front of the boiler, owing to the combustion of the smoke taking place there, and a large body of flame is thus carried through the flues beneath and around the boiler, and thus I conceive that we are able with more ease and less fuel to make steam than by the ordinary method. The only disadvantage which I ever found in its use, I think it proper to mention, as also the plan by which it was remedied. When I first adopted the plan, I soon found that the air-plate which lines the passage was, by the force of the fire, completely burned and destroyed at the one end, so as in a manner to be rendered useless. To remedy this, and to protect the plate from the heat, an arch of fire-brick was thrown over the furnace, at I, immediately under the end of the plate, and between it and the fire, and by this the plate is completely protected from the effects of the flame. I have had the method with the plate thus protected in constant operation for more than three months, and I find the air-plate is not in the smallest degree injured during that time. This objection is therefore completely removed.

I am quite convinced that, were a few of our townsmen to adopt this plan, and to give it a fair trial, its advantages to the public would become so apparent, that it would be very universally used.

I am, Gentlemen,
Yours, &c.
John Roberton.

MR. BRYCE'S STOMACH SYPHON.

Mr. Bryce, Surgeon in Edinburgh, has lately proposed an instrument, to be used in place of the syringe, with double pipes and stop-cocks, or valves, for the purpose of throwing liquids into, or extracting them from, the stomach, according as may be judged necessary.

The instrument consists of a very smooth flexible tube, about twenty-four inches in length, called by surgeons an œsophagus tube, and a second tube made of coarser materials, and resembling those used by tobacconists. This tube is about three feet in length, and is mounted at one end with a brass tube, fitted to a similar mounting on the extremity of the œsophagus tube, so as to slip in and out at pleasure, and, when joined, to be quite air-tight; and to the other end is fixed a bladder of size sufficient to hold a quart of fluid, and having a ring and stopper at its extremity, for the purpose of filling or of emptying it as may be necessary. The following is the method of using this instrument.

The œsophagus tube is to be introduced through the nose or mouth into the gullet and stomach, after the manner usually done by surgeons; the brass mounting of the second tube is then to be slipped into that of the œsophagus tube, and the bladder having been previously filled with tepid water, or with whatever fluid it may be desired to throw into the stomach, is now to be raised along with the flexible tube towards a perpendicular over the patient's head. The fluid will then quickly pass from the bladder into the stomach; and, for the purpose of extracting it again from the stomach, all that is necessary is to lower the bladder considerably below the level of the stomach, by which it is evident that a perfect syphon will be formed, from the action of which the liquid contents of the stomach will be quickly transferred into the bladder. By opening the stopper of the bladder, the contents may now be received into a vessel for examination; and by again filling the bladder with fluid, the operation of filling and emptying the stomach, by raising or depressing the bladder, may be repeated as often as may be judged necessary.

It is proper to observe that as little air should be left in the bladder, before shutting the stopper, as may be; and this is effected with sufficient accuracy, simply by compressing the bladder upon the contained fluid, or by gently twisting its sides together before putting in the stopper.

The use of this instrument is recommended in cases in which persons have swallowed an overdoze of laudanum, or have taken strong spirits to a great excess, or in which other poisons in a fluid or easily soluble form, have been taken into the stomach.

Mr. Bryce has himself ascertained the efficacy of this instrument, and it has also been found effectual for the purposes for which it is recommended, in the hands of others. For a more minute account of this stomach syphon, of the advantages which it is said to possess over other instruments which have been recommended for the same purposes, and of the ease and efficacy with which it operates, reference is made to the Edinburgh Medical and Physical Journal, vol. XXIII. pp. 220 and 416.

This instrument is constructed in the most approved manner by Mr. J. M'Leod, surgeons' instrument maker, Edinburgh.

Reference to the Plate.

Fig. 3: A, the œsophagus tube; B, the second tube, with C, the attached bladder; *d, e,* the brass mountings; *f,* the stopper.

Fig. 4: (the pieces of fig. 3. joined as a syphon:) A, the œsophagus tube, or short leg; B, the coarser tube, or long leg; C, the bladder; *f,* its stopper; *d, e,* the brass mountings.

IMPROVEMENTS IN THE CITY, AND PROPOSED NEW STREET.

By Mr. John Hart, Glasgow.

> "Let Glasgow flourish, still in grandeur rise,
> And rear her stately fabrics to the skies."

Gentlemen,—In this age of improvement, when the cities of our empire are vieing with each other in removing nuisances, opening new streets, improving harbours and public roads, to increase the comfort and facilitate the commerce of their respective communities, it is necessary that Glasgow should bestir herself, to keep pace with her neighbours. No one who takes a look of Argyle-Street, will say that the recent erections between the foot of Buchanan-Street and Union-Street, have shown the liberality of the Dean of Guild Court and proprietors, or their taste for the improvement of the city: they have, in fact, rendered Argyle-Street unfit for the increasing trade of the city, and made it necessary that some plan should be adopted to secure that convenience which is necessary in the public thoroughfare to the harbour. Permit me, therefore, through the medium of your Magazine, to call the public attention to a plan which I propose for securing free and uninterrupted access to and from the harbour, and the other parts of the city.

I propose that a new street shall be opened up, not to be less than 80 feet wide, from the foot of Jamaica-Street, and to be carried through in a straight line to Whitevale; from thence continued in a gentle bend or crescent, till it meet the junction of the two roads from Edinburgh, by Airdrie and by Cumbernauld. Another crescent might be made from where the proposed street crosses Barrack-Street, to join the great London and Edinburgh Road by Camlachie, or a junction might be made between the two roads before the latter enters Camlachie, and near to that which is intended to be opened up from London-Street. To give a more distinct idea of this proposed street, let two lines be drawn upon a map of the city, one from the north-east corner of the New or Broomielaw Bridge, passing along the north wall of the officers' rooms in the Infantry Barracks till it reach Whitevale, which will be the south-east side of the street; and another from the corner of the house at the foot of Jamaica-Street, on the west side, parallel to the other, till it also reach Whitevale, as the north-west side; if a curve be then drawn from Whitevale to the junction of the Airdrie and Cumbernauld roads, and another from where the proposed street crosses Barrack-Street, through the unbuilt ground to the foot of Sydney-Street, a clear idea will be had of the improvement proposed, and its incalculable benefit to the comfort and accommodation of the citizens.

As, however, some of your readers may not have a map of the city, I shall endeavour to point out the line which it is proposed the street shall occupy. It will be in a line with the Broomielaw Quay, and will pass through part of the corner house of Jamaica-Street and Clyde-Street, through part of the Bottle-Work, cross Dixon-Street, and angling across Howard-Street and Maxwell-Street to the south of the Eagle Inn, (which would become a corner house,) pass through part of the Inn-yard, and through the old buildings at the foot of Turner's Court, formerly occupied as a brewery; it would then pass through two houses at the foot of Dunlop-Street, through part of Jackson-Street, and the wood-yard formerly occupied by Mr. Waddel; it would enter Stockwell through the second land above Jackson-Street, passing through two old tottering tenements on the opposite side, and through to King-Street; thus opening up to the free air of heaven, one of the greatest nurseries of pollution in our city, and making room, in the very centre of the city, for the whole of the Public Offices. It will then enter King-Street, through the third and fourth tenement from the Trongate, pass through two low tenements on the opposite side, then through the Tron Church, removing it to a more light and airy situation, on the south side of the proposed street, with a front to it and to Prince's-Street, and removing back the objectionable part of the corner land that now obstructs London-Street, and the five old tenements to the west, pass the Cross, through the corner land, and the tenement to the east, on the north of the Gallowgate, then through a succession of crazy wooden buildings, old tan-works, &c. till it reached the Molendinar Burn, then through the centre of Mr. Davidson's property in Spout-mouth, and by the north end of the Dove Hill through part of the property occupied by Mr. Young; it then passes obliquely through Graham-Street, passing to the north of St. John's Church, and continuing onward, go between the Infantry Barracks and their hospital, crossing Barrack-Street, passing through part of the brick work, and along the south front of Annfield House to Whitevale. This then will give a straight line of street from the light-house quay to Whitevale, being nearly two miles and a quarter in length, with a gentle declivity the whole way, and which would open up a safe and easy communication between the harbour and public roads, to all parts of the city. From its oblique direction with the present streets on each side, it will render the risk of accident much less than at present, their junctions with the main street being all at right angles, which renders the passage of coaches, &c. peculiarly dangerous. The filthy and confined wynds would then assume a more healthy appearance, and become somewhat like Nelson-Street or Brunswick-Place, and the various streets which intersect the proposed opening, would, like so many streams, pour their tributary waters into the mighty river.

As the prevailing winds are W. and S. W. a constant succession of fresh air would sweep through the city during the greater part of the year, carrying off the noxious exhalations, and securing health and vigour to the inhabitants; and if the style of building was conducted with good taste, there would not be a finer street in the kingdom; the city, with her numerous spires, might then be seen at one view, from one end almost to the other. Numerous valuable sites would also be afforded for Public Buildings which are at present so much wanted in this city. The Merchants' Hall might be built between Dunlop-Street and the Stockwell, which would be in the centre between the projected Exchange in Queen-Street, the old Exchange or Corn Market, and the harbour. The removal of the five lands at the Cross backward, would make the street opposite the present Exchange at least fifty feet wider than at present, thus giving a light and cheerful appearance to the whole; here too, might be erected, a pillar to a nobler name than that of Trajan or of Buonaparte, which meeting the eye of the steam-impelled traveller, would tell him that in this city was the steam engine brought to its present state of improvement; and another to him whose merits are too much forgot, the patriot Wallace.

In looking over the map, it will be seen that only four shops and two spirit cellars in Stockwell, four shops in King-Street, and those in the Courier Office land at the cross, will be altogether removed, the rest of the line is chiefly back property, or in small streets and lanes.

The distance from Jamaica-Street to Stockwell is, 1500 feet, equal to 200 shops, allowing 15 feet per shop; from Stockwell to King-Street, 625 feet, equal to 83 shops; from King-Street to the opening into the Trongate, 350 feet, or 46 shops; the remainder in that line, till it reach the Cross, will only be removed back from their present site to the south side of the projected street; from the Cross to the Dove Hill is 1000 feet, or 132 shops; in all equal to 3475 feet of front on each side, or space for 462 shops between Jamaica-Street and Little Dove Hill; beyond this the population is not yet dense enough to support them, but from the ready access to the city, buildings may be expected to extend to the east, all the way to Whitevale; so that the demand for shops would gradually extend in this quarter likewise.

It may be objected that among so many proprietors, it would be difficult to carry through this street. I am of the same opinion if a Joint Stock Company were to attempt it: but let the proprietors on the line meet and form a committee of themselves; and let this committee, for the benefit of the whole, take a list of all the property, with the present rental. Now, as a number of the properties would be removed to form the street, and the rest would be raised in value, a proportion would require to be assigned to those whose properties are removed. But as several of them may object to this mode, I have no doubt but the rest of the proprietors, or the Town Council, or even a company might be formed, who would take their shares, either by purchase, or by giving them property of equal yearly value to that given up, or they might guarantee to them a certain rent, or feu, on the new property solely; on their being allowed to receive their share of the surplus obtained by the sale of steadings on the new line; or the properties might be sold publicly by the company, and the money be paid over to the proprietor, the new purchaser to conform to the rules of the company. It may be objected that this street will reduce the value of property in the Trongate and Argyle-Street; but as these are already full of shops and warehouses, and the demand for them still great, they are spreading westward to Anderston. Now it is a fact, that shops never thrive unless there be a number of them together; therefore, the Trongate property would not be deteriorated, because what was not to be had in the Trongate would be more easily found in the projected street, than by a walk to Anderston. All this, however, is not to be the work of a day. This improvement, and that of the harbour, would create such a demand for labour, as would materially increase the population. Hoping that the public attention may be secured to this suggestion,

I am, yours, &c.
JOHN HART.

Mitchell-Street, 25th October, 1825.

ON THE LATE LAMENTABLE ACCIDENT AT GOUROCK, AND PLANS FOR PREVENTING THE LIKE OCCURRENCE IN FUTURE. By Mr. Henry Bell, Helensburgh.

Gentlemen,—The dreadful accident which took place from the Comet and Ayr steam boats coming in contact with each other off Kempoch Point, about three miles below Greenock, betwixt 1 and 2 o'clock on Friday morning, the 21st October, by which the former was run down, and a great many lives lost, makes it necessary that some steps should be taken to prevent in future, as far as possible, such accidents occurring through carelessness or mismanagement.

As I have had the honour of bringing steam vessels into practice in Great Britain, as well as other countries, I beg leave to suggest what would, I conceive, be an improvement, and be for the safety of the lieges.

1st. I would recommend a bill to be brought into Parliament, laying down a proper code of laws and regulations for the management of steam vessels. I have had much experience in steam navigation, and have made it my study to observe and watch over all its movements, and I now plainly see that it is absolutely necessary, for the interest of all concerned, that the Legislature should interfere, as the present accident, as well as that which formerly occurred, arose entirely through carelessness. In these laws, it is by no means to be wished that commerce should be fettered with unnecessary expenses or delays; and I would suggest what I conceive would answer all the purpose required. I would recommend that each steam boat should be licensed, and numbered as stage coaches; and in these licenses, that the tonnage of the vessel, and number of horse power of the engine, should be inserted. The expense of the license not to exceed one shilling per horse power, on a stamp of 5 per cent. on the value of the license.

2d. That all steam vessels at or under twenty horse power be restricted not to carry on board, at one time, more than forty passengers, (children from six to twelve years of age to count as one half passenger,) each passenger to be allowed 56 lb. of luggage; and all steam boats upwards of twenty horse power, to be at liberty to carry one passenger more for each horse power above twenty. Thus, a boat of fifty horse power would be licensed to carry seventy passengers, independent of the crew; licenses to be taken out annually.

3d. That those vessels be navigated by experienced seamen, for captains, pilots, mates, &c., and should also have experienced engine-keepers, of which the proprietors must produce certificates, and for whom they should be responsible, and these peoples' names to be indorsed on the license.

4th. That those steam vessels be at least furnished with two lights, one on the bow, and one at the mast-head, to be put up at one hour after sun-set, and properly attended to; also an alarm bell, at night, attached to the engine, and a proper watch kept a-head with a speaking-trumpet to direct the steersman of the vessel.

5th. That all steam boats, meeting each other, give way to the larboard side, and all steam boats when overtaken by a swifter one, do the same, and allow them to pass on their starboard side, by stopping their engine as soon as the one over-taking them comes within 30 feet of their stern; and all sailing vessels to give a sufficient birth for steam boats passing with freedom, not being properly attended to, has formerly caused the loss of lives.

6th. That a general inspector be appointed for examining each steam boat and its engines, machinery, &c. whose certificate will enable them to get their licenses, he having power to appoint competent deputies at each proper station, who may call in proper judges to decide upon any disputed point between the proprietors and inspectors, the salaries to be paid from the licenses.

A great number of other regulations might be suggested, regarding accommodations at harbours, ferries, &c. which might be introduced in the bill, and I hope the few hints I have thrown out, or such like, will show the public the necessity of some better regulations being immediately adopted.—I remain, a friend and well-wisher to the good of my country and safety of my fellow-creatures,

HENRY BELL.

Baths, 25th October, 1825.

GLASGOW GAS WORKMAN'S INSTITUTION.

Re-opened for the Season.

INTRODUCTORY ADDRESS.

THIS useful Institution, which we have already noticed in different Numbers of our Magazine—which has been extremely beneficial in exciting a spirit for obtaining knowledge and instruction among the workmen attending many public works both here and in England—and which was the first to set the example of the excellent system of self-instruction now so extensively adopted, was opened for the season on the 8th of September last. On this occasion, Mr. Burns of Buchanan-Street, Glasgow, at the request of the Committee, delivered an introductory lecture on Geology, which we hope soon to be able to lay before our readers. Previous, however, to delivering this lecture, Mr. Burns took the opportunity of addressing to the members of the Institution, some general remarks on the importance of those studies which it is the peculiar object of their Institution to cultivate. We have been favoured with the following copy of Mr. Burns' observations:

The importance of any study must be in proportion to its utility; and the useful end to which all studies ought to be made subservient, is the increase of the general welfare and happiness of mankind.

The beneficial results, however, of many discoveries and inventions are often so distant, that we are frequently led to call in question their utility or their tendency to promote the grand object of human improvement.

The invention of gun-powder, for instance, may have been called a diabolical contrivance, by which the horrors of war were increased, and its ravages more widely extended; but the change produced in the mode of warfare by this invention, has put an end to that chivalrous spirit which taught men to look on war as the only road to honour and renown, and treated the arts of peace as ignoble, and their followers as slaves. The art of war, however, is now no longer the only acquirement worthy of encouragement or reward; nor is personal prowess a necessary qualification of the candidate for future fame; the ambition of mankind is now directed to pursuits of a more peaceful and humanizing character: literature, the arts and sciences, are paths to fame and glory more certain and attractive; and mankind in pursuit of these are now repairing the ravages and devastations of their former ill-directed energies. Strength of mind by this invention has now assumed its superiority over mere strength of body.

The art of printing might also be pointed out to show that we must not view the importance of a discovery or an invention from its immediate effects; for many discoveries, and many pursuits of the philosopher, are looked on as trifling, which afterwards become corner-stones in the general superstructure of human acquirements.

To view, then, in its true light, the benefits which have resulted to the human race from the study of science and their acquirements in the arts, we must compare the present state of comfort and happiness which man enjoys, arising from these causes, with the wretched and miserable state of the savage tribes who have made little or no progress from their state of ignorance along this road of improvement.

If we examine the accounts of our numerous navigators and travellers, we find that there are hordes of savages whose rude implements and untaught minds are less effective in defence and support than the instincts of the brutes that howl around them.

Such is the state of man without art or science, that the eagle and the fowls of the air hover and scream over his head, regardless of his rude arrow:—the lion and the beasts of the forest despising his club and mis-shapen battle-axe, put him to flight in terror and dismay, and remain lords of the forest: even the very insects that flutter around him, and annoy him with their petty stings, seem, as if in mockery of his helplessness, to dazzle him with the glitter of their gilded wings, and to increase in loudness their eternal hum of life and joy! But see him as he acquires art after art, and science after science, his rude canoe transformed to the majestic ship; his bow and arrow, his club and battle-axe, he gives up for the implements of husbandry, and the tools of art: instead of starving on a few scanty roots, he now views his thousand fields waving with their golden harvest, or covered with his innumerable herds of cattle: instead of pining in solitude in his rude hut, he, by his improved and acquired arts, builds his cities and his palaces; by the aid of science he collects the produce of an hundred climes; he ransacks the bowels of the earth, and brings to light its hidden treasures; and even the very elements he subdues, and renders subservient to his use:—it is then he takes possession of his birth-right—it is then, and not till then, he subdues and obtains dominion over the fowls of the air, the fish of the sea, and over every living creature on the face of the earth.

Ought we then to remain ignorant of those arts and sciences which have produced such a wonderful change? Shall we remain contented with what has been done for us, and do not exert our energies in the same paths? Certainly not. Whatever sneers and ridicule may be applied to our humble endeavours, let us recollect that often from the humblest ranks have arisen men eminent for their discoveries and inventions. We have no right to sit down and enjoy those comforts, (which are the result of a long series of improvements,) and remain ungratefully ignorant of the causes which have produced them. Let us recollect also, that as kingdoms are wealthy by the general diffusion of riches, so are the wise by the spread of knowledge. No nation can be called rich, merely because a few ancient families have annexed immense treasures to their overgrown estates; nor can a country be famed for its knowledge, which has merely a few richly endowed seminaries. This, however, is a maxim that has been tardily acknowledged. That proud aristocratic feeling, which would elevate the few by the oppression of many, has strained every nerve to keep things as they were: the pre-eminence of a few can only be maintained by the ignorance and poverty of those around them. But the road to wealth and honour is now open to all; the gates of wisdom have been thrown wide, and knowledge is spreading; and this hall in which I now stand, and the society I now address, is amongst the first fruits of a happy change.

It has often happened that when any great change takes place in the opinion of the people, that those who have influence and power, leading and directing, have used every endeavour to curb and to crush it; but the history of the religious and political revolutions of our own country have shown, that opposition in such cases is in vain: opinions once formed, and changes once set agoing, no human force can control.

The liberal and intelligent of this age, however, have shown themselves convinced of this truth; and instead of thwarting or endeavouring to check the present desire for knowledge, have come forward to patronize and encourage it.

The assistance and encouragement you have met with from your employers is a noble example of liberality of sentiment and kindness of heart, which ought to call forth not only your gratitude, but the applause of the world: and it must be gratifying, not only to you but to every friend to the scientific education of the mechanic, that their cheering example has been followed by others. There is an establishment within a few hundred yards* of us, conducted by men of enlightened minds, who, from kindred feelings, have given the same facilities and encouragement to their workmen; and I feel confident that your conduct, and that of those employed in the establishment I have alluded to, afford the best answer to those enemies to the instruction of the people—who would endeavour to persuade their countrymen that in proportion as the working classes acquire knowledge, discontent and a dereliction of their duties must follow.

But to return to the importance of scientific studies, and the necessity there is to acquire general information. It is a melancholy fact, that in this city (a city which has arisen from a paltry village to be the second city in the empire, solely by the discoveries and improvements in the arts and sciences,) there are thousands who revel in the wealth these discoveries have produced, and yet remain ignorant of the nature and principles of those sciences and machines which have thus enabled them to acquire their fortunes! How many hundreds do we find weekly emigrating to their bathing quarters in that delightful conveyance the steam-boat, who know as little of its machinery as the groom knows of the principle which animates the muscles of his horse! Nor is this ignorance alone chargeable on those who have means of enjoying the result of the labour of others; but even in our workshops and manufactories will we find many who are little better than parts of the machines around them. The movements and principles of that noble engine, which gives life and motion to all their operations, is as little heeded as the motion of the earth round its axis. This apathy knowledge alone can eradicate: novelty, no doubt, sometimes excites our attention, and raises our curiosity. I recollect, some years ago, when crowds assembled to view the lighting of the first shop with gas: inquiries were eagerly made to gain some information about this beautiful and novel discovery; and every boy had his tobacco-pipe for a retort—but now, when we are accustomed to see, night after night, our streets, our houses, and workshops, lighted up, as if by magic, we think nothing of it; and speculate as little about it as we do about the cause of the sun's light.

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* Mechanics' Institution of the University Printing-Office.

Increase of knowledge must dispel this indifference to things around us: knowledge, were it but to do this, must be valuable; were it but to make us acquainted with what has been done, it ought to be acquired; and when we consider the benefits it has always conferred on those who have acquired it, who will refrain from pursuing it?

Much has been said and written on the subject of scientific education, and the effects likely to be produced by its introduction amongst the working classes; but from what I know of the effects produced in this establishment, it would be an idle waste of words to combat one opinion that is entertained, or, by farther arguments, to support another. The fruits of the system are beginning to appear, and by the fruit shall ye judge of the tree.

Permit me, in conclusion, to congratulate you on the mode of study you have adopted in this place. It is obvious that you will acquire a more accurate knowledge of thevarious objects of your study, from the circumstance of your being obliged to explain and discuss the matter with your companions. When one of you has acquired an accurate knowledge of that which is interesting to himself, his explanation of it to his companions must be more satisfactory than the usual manner in which it is treated of in books; for every one is aware that a short verbal description of a piece of mechanism, or operation, conveys a more intelligent idea of it than the most elaborate written account. Experiments, likewise, when made by yourselves, will completely fix the matter in your minds. The fact is, you have then done the thing, and, of course, know all about it.

CAPTAIN SPENSER'S LIFE-BOAT.

A TRIAL was made on the 3d instant, at Kyme, of a boat, furnished with copper air-tight cases, according to the plan recommended by Captain R. Spenser, R. N. in order to obviate the great expense of the regular life-boat. The boat was of small dimensions, and borrowed for the purpose: under the thwarts were placed the air-tight cases of thin copper, enclosed in boxes of three quarters of an inch Norway deal, for greater security; outside the boat, and attached to the gunwale, were also two similar cases, five feet in length, and eight inches square. Captain Spenser found three seamen volunteers to accompany him; when having pulled out the plug, and filled the boat with water, they rowed out where the sea ran the highest, and laid the broadside nearest the surf, which broke over so violently as to render it difficult for the men to prevent themselves from being washed out of the boat. Having fully ascertained she was perfectly safe when filled with water, they baled her out and rowed out into the heaviest sea to the S. E. point of the Bobb, where she was placed in every direction to receive the shocks of the sea, which were sustained in a manner such as the most sanguine could not have anticipated. The success of the plan will be extremely valuable to the merchant service, as, by procuring six cases, the common ship's boat may in a few minutes be rendered a life-boat.

THE ELEMENTS OF GEOMETRY AND TRIGONOMETRY. By DAVID MACKIE, Lecturer on Mathematics at the Glasgow Mechanics' Institution. Publishing in Parts. *

THOUGH we are not in the habit of reviewing single parts of a work such as this, and indeed it is hardly so proper to do so, as it is impossible to judge of it completely till the whole makes its appearance, yet we think there are some peculiarities in the work, the title of which is prefixed to this article, which fully justifies us in departing from our accustomed practice, and pointing out a few of those peculiarities to our readers.

It is almost a universal complaint among students of geometry, at their outset in the science, that they cannot perceive the utility of the different theorems and problems which puts them to so much trouble, and which they frequently find it so difficult to demonstrate and solve. This complaint Mr. Mackie has done something to remove, by the introduction of several interesting practical applications of the various propositions, either in the form of corollaries or scholia.

Instead of following the beaten tract in the arrangement of his propositions, he has judiciously adopted many of the most recent improvements which have been made on the elements of this science.—Among these we may notice, in the first place, the following, which we consider a very obvious improvement. This is in the first proposition. Euclid's first is, "To describe an equilateral triangle upon a given straight line;" and he afterwards introduces another proposition, "To describe a triangle whose sides shall be equal;" which is the general proposition, the first quoted being merely a case of the latter. Mr. Mackie, however, like Professor Leslie, has brought the general proposition to the beginning of the elements, and from it he very naturally deduces the mode of describing both an equilateral and an isosceles triangle, for when the three given lines are equal, an equilateral triangle is produced, and when two of them are equal, an isosceles. This plan has the advantage of enabling him to introduce, in subsequent constructions, the use of the isosceles triangle, when Euclid has been under the necessity of using the equilateral, which is far from being so convenient.

A number of propositions generally demonstrated indirectly, or by the method of *reductio ad absurdum* in other works, is, in the one under consideration, proved by the direct method, which, though it may not be more conclusive, is unquestionably more agreeable to the student. In the definitions, where there is a good deal of originality displayed, we see much to commend. The view which is given of angles, cannot fail to dispel much of that obscurity which seems to envelope the subject as it appears in many works of geometry. The definitions commonly given, convey no definite notion of angular magnitude or measure.—But by the manner in which the subject is here treated, we may acquire, in a very short time, the most correct knowledge of these properties, a circumstance the more important, since every teacher of the science must know how much the progress of his students depends on their having clear and accurate conceptions of them. Theory may be looked on as idle speculation, unless it tends to illustrate and direct practical operations; and we cannot but view Mr. Mackie's method of treating angles as one of the best fitted we have seen for leading the student to the practical parts of mathematics, where the measurement of angles is often required. Indeed, almost every instrument which is put into the hands of the learner, for ascertaining the magnitude of an angle, will, during the operation, exemplify the definition here given, that "the measure of an angle is the portion of a revolution which one of its sides would perform by revolving about the vertix into the position of the other side." The whole of the definitions, we may add, are very plain and well illustrated with neatly engraved figures.

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* The Profits of this Work to be given in aid of the above Institution.

Having said this much in praise, and we are aware we might have said more, we must, before leaving the subject, notice one or two points in which we think the author has erred. In the first place, then, we do not approve of deducing so many corollaries as he has done from the course of the demonstrations. It may do very well for his own pupils who know where to apply, should they not readily perceive their connection with the demonstrations; but other students, without this aid, might require to search no little time before arriving at a conviction of the truth of some of these corollaries. Sometimes, no doubt, a particular illustration is given; but, considering the importance of some of the truths, which are drawn from some of them in certain steps in the course of the demonstration, we should have liked as well to have seen them introduced and demonstrated as separate propositions. The next fault we have to point out, is the omission of a definition of a plane surface—a term which is often made use of in the work, and which cannot be avoided. This we cannot suppose to be an intentional omission, but merely an oversight, which, therefore, we shall expect to see remedied in future editions.—Upon the whole, however, this work promises to be one of great utility as a text book; and we trust we shall not be disappointed in our expectations of its doing honour to the highly useful and important Institution from which it has emanated.

MISCELLANIES.

Dr. Grant on the existence of the Pancreas in some species of the Cuttle-Fish Tribe.—Dr. Grant lately read a paper before the Wernerian Society on certain glandular organs of the *Loligo sagittata, Lam.*, the most common species of *Calmar* of the Firth of Forth. These glands are situate at the lower and fore part of the liver, are two in number, consist of numerous distinct lobes, of a rose-red colour, and were formerly considered as the ovarium of this animal. It appears, however, that they surround the two biliary canals during their whole course from the liver to the spiral stomach, and communicate freely with the interior of these canals, by numerous small ducts. They are always present, and equally developed, in the male and female, and have no organic connection with the organs of generation. Coloured size injection thrown into the digestive canal, passes up from the spiral stomach, through the two biliary ducts, and fills these glandular lobes in its passage. From the connection of these glands with the biliary system, Dr. Grant considers them as analogous to the conglomerate pancreas of the skate, and other chondropterygious fishes, and is thus inclined to believe that this important digestive organ occurs lower in the scale of animals than is generally supposed. Dr. Grant illustrated his observations, by numerous specimens of the male and female, showing the viscera in their natural as well as injected state.

Fossil and Live Shells of the same species differ according to Locality, Distance, &c.— It has been remarked, that the same fossil shells found in places at a distance from each other, always exhibit some differences in their form, the deepness of their grooves, the degree of projection of their spines, &c. Mr. Basterodt affirms the same to be the case with living species, as he found that they do not exhibit the same characters in places separated at considerable distances from each other, or even in near localities, when the heat, humidity, nourishment, &c. are different. Hitherto but little attention has been paid to those local differences; hence it has happened that new species have been proposed, which were only varieties of known species. This fact is of great importance in a geognostical point of view.

The same Fossil species of Shells are associated with different suites of species in different localities.—The same species of fossil shell may occur in deposits situated at considerable distances from each other, but in these different localities the species are not grouped with the same set of species. It is also a matter of observation, that fossil shells of the same species are more and more numerous in different basins of the same era of formation, the nearer these basins are to each other. In illustration of this latter fact, Basterodt informs us, that, of the 270 species which he found in the vicinity of Bourdeaux, but 82 occur in the depots of Italy, 52 around in Paris, 21 in the tertiary basins of England, and only 17 in the basin of Vienna in Austria.

Greater constancy of character and association in the Organic Remains in Old than in New Rocks.—The fossil organic remains in ancient depots or formations, exhibit more constancy in their characters, and in their associations in different localities, even when at great distances from each other, than is observed in the more modern formations. Thus, the same species of trilobite, and without any variety in form, &c. is found in the transition limestone of France, England, North America, &c. Other fossil organic remains, with absolutely the same characters, occur in the transition slate of Wales, Northumberland, Finisterre, Cotenten, Ardennes, Hundsruk, Hark, Mark, Columbia, New York, Pennsylvania, Lake Oneida, in North America.

Iodine discovered in various marine productions.—Soon after the discovery of Iodine, Messrs. Gaultier de Claubry and Colin pointed out starch as the most sensible of the re-agents that manifest its existence. It is in fact sufficient to pour an aqueous solution of this vegetable substance into the liquid supposed to contain iodine, to produce immediately a blue colour, which arises from the formation of an iodine of starch. M. de Ballard, after improving the means of operating with this re-agent, announces his having discovered iodine in bodies which were not hitherto known to possess it, for example, in various marine mollusca, both naked and testaceous, such as the animals of the genera *Doris*, *Venus*, *Ostrea*, &c., several Polyparia and marine vegetables, *Gorgoniæ*, *Zostera marina*, &c., and, in particular, in the brine of salt-works fed by the Mediterranean. The very small quantity of iodine found in the water of the sea, has prevented his determining in what state it exists, but there is reason to suppose that it is in the state of hydriodate.—*Annales de Chim. et de Phys.*, *Fev.* 1825.

Improved Cement for holding small Lenses, whilst grinding and polishing them.—In grinding small lenses, Mr. Pritchard found that shell-lac, the cement usually employed for them, was by no means sufficiently strong to retain them. He was fortunate enough, however, to attain his object by adding to the shell-lac an equal weight of finely levigated pumice, carefully melting them together in an iron-vessel, and stirring them till well incorporated. Great care is required in using it, not to heat it hotter than is absolutely required in melting it, and in fixing the lens securely, otherwise it becomes unfit for use; and the same caution is equally required in using shell-lac alone.

To make Oats prove doubly Nutritious to Horses.—Instead of grinding the oats, break them in a mill; and the same quantity will prove doubly nutritious. Another method is, to boil the corn, and give the horses the liquor in which it has been boiled; the result will be, that instead of six bushels in a crude state, three bushels so prepared will be found to answer, and to keep the animals in superior vigour and condition.

Olivine.—According to Stromeyer, who has just published an interesting account of his chemical examination of this mineral, it contains the following parts: olivine, from the basalt of the Vogelberg, silica, 40.09; magnesia, 50.49; oxidule of iron, 8.17; oxide of nickel, 0.37; oxide of manganese, 0.20; alumina, 0.19; = 99.51. Olivine of Kasalthof, in Bohemia, contains, silica, 40.45; magnesia, 50.67; oxidule of iron, 8.07; oxide of nickel, 0.33; oxide of manganese, 0.18; alumina, 0.19; = 99.89.

Crysolite.—According to Stromeyer, the following are the constituent parts of this mineral: silica, 39.73; magnesia, 50.13; oxidule of iron, 9.19; oxide of nickel, 0.32; oxide of manganese, 0.09: alumina, 0.22; = 99.68.

On Molasse Sandstone.—Studer of Berne has published a large volume in 8vo. with two plates, on the particular sandstone rock named in Switzerland Molasse. In it he agrees with Boue and Necker in separating the true tertiary molasse from a far older calcareous sandstone deposit, which extends from Savoy to Austria, all along the base of the Alps. This older molasse somewhat resembles the greywacke of the Apennines, but differs from it in containing more organic remains.

Phosphorescence of Potatoes.—Lichtenberg tells us, that an officer on guard at Strasburgh, on the 7th January, in passing the barracks, was alarmed on observing a light in one of the barrack-rooms. As this was strictly prohibited, fire was suspected, and he hurried forward to the apartment. On entering it he found the soldiers sitting up in bed admiring a beautiful light, which proceeded from potatoes in an incipient state of putrefaction. The light was so vivid, that the soldiers could see to read by it; it gradually became less and less vivid, and entirely disappeared by the night of the 10th of the month.

Manchester Canal.—A magnificent project has been lately proposed for giving Manchester the advantages of a sea-port, by making a canal, navigable for large ships, from that town to the Dee. Mr. Chapman, an experienced engineer, has made a survey (a running survey apparently) of the ground, and pronounces decidedly in favour of the practicability of the scheme.

Steam Boat on the Rhine. — An extraordinary interest was excited at Coblentz lately, by the first appearance there of a steam-boat on the Rhine. How strikingly does this single fact display the comparative backwardness of the neighbouring countries! The Rhine flows through a valley thickly inhabited by six or eight millions of people, it has a depth of five or six feet at a *minimum*, the greater part of the year; and from the frontiers of Switzerland to the sea, in a line of 500 miles, it has not a single cataract. It presents, in fact, the finest field for steam-navigation at present in the world, and had such a river flowed amidst an equal mass of population in America, the steam-boat, instead of being a stranger to its waters, would have covered them in hundreds.

To render Tainted Meat fit for use.—Meat tainted to an extreme degree may be speedily restored by washing it in cold water, and afterwards in strong camomile tea; after which it may be sprinkled with salt, and used the following day; or if steeped and well washed in beer, it will make pure and sweet soup, even after being fly-blown.

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THE GLASGOW MECHANICS' MAGAZINE,

CONDUCTED BY

A Committee of Civil Engineers and Practical Mechanics.

> "With gold and gems if Chilian mountains glow,
> If, bleak and barren, Scotia's hills arise;
> There, plague and poison, lust and rapine grow;
> Here, peaceful are the vales and pure the skies,
> And Freedom fires the soul, and sparkles in the eyes."

No. XCVIII. *Saturday, 5th November,* 1825. Price 3*d*.

NEW POWER-LOOM.

Fig. 1.

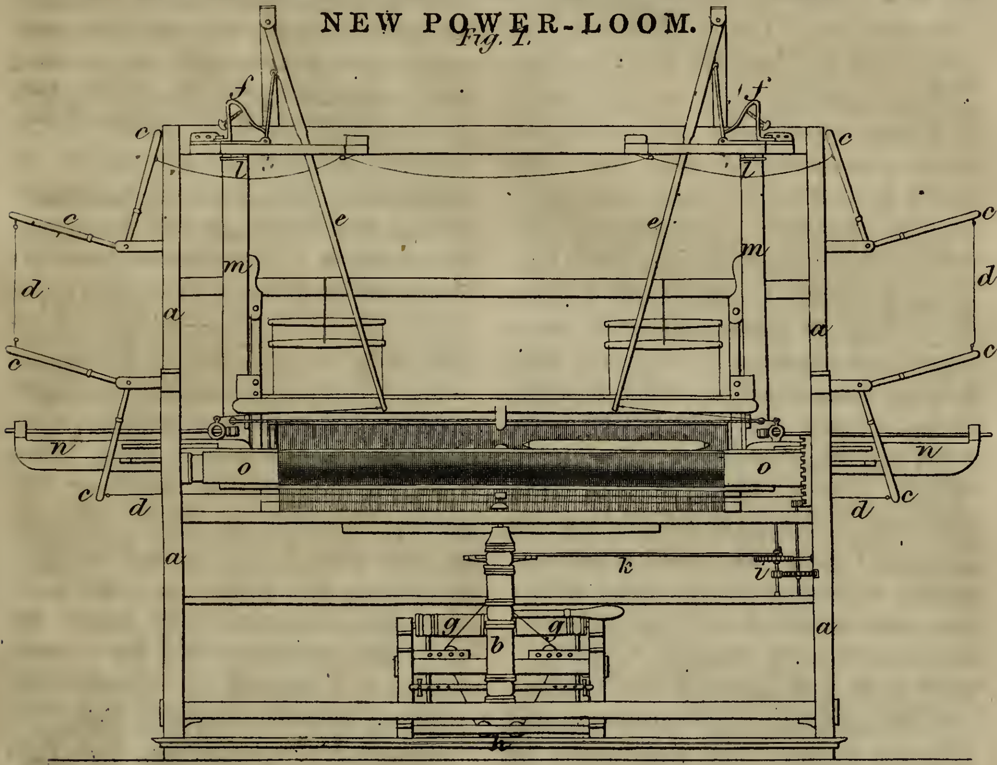
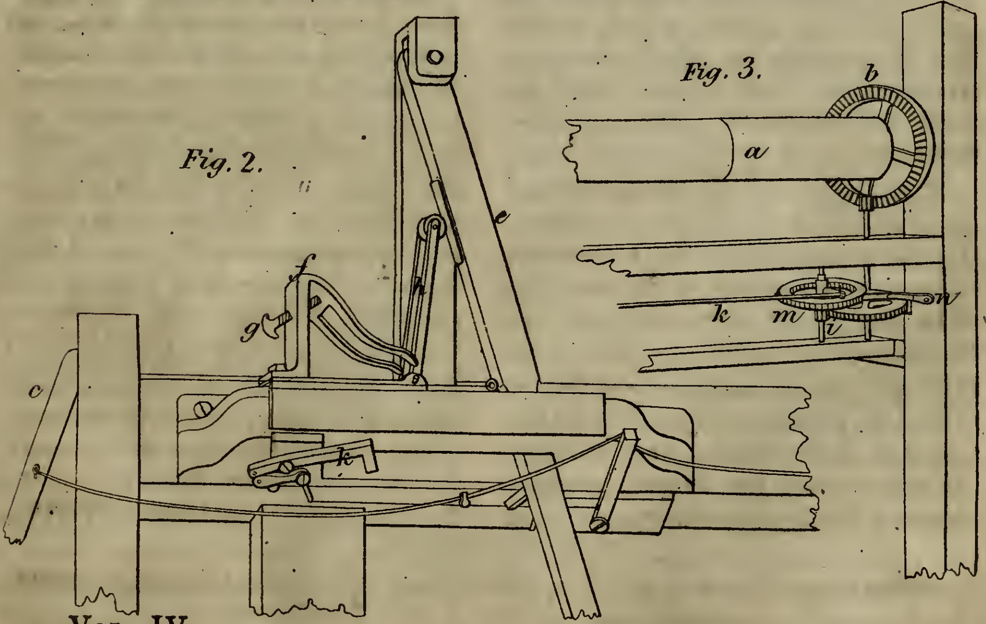


Fig. 2.

Fig. 3.



Vol. IV.

— Swan Sc —

NEW POWER-LOOM.

By Mr. George Whyte, Glasgow.

Gentlemen,—Having invented a power-loom, particularly adapted to the weaving of fine fabrics, I send you a description and drawing of it for publication in your Magazine. The loom which I offer is new, both in its principle and construction: it will, therefore, be necessary to describe it as particularly as possible. It is difficult to describe machinery so as to be easily understood; and the difficulty is increased by the originality of the machine. As parts of the machinery are different from any thing I know, I have named them according to their apparent uses: if, in consequence of this, any ambiguity has arisen, or if my description in any part seems obscure, reference may be had to the model, which I have made; it is in good working order. It might not be improper here to make a few remarks to prepare your readers for the description which must be reserved to next number,* when a side view and some of the sections will be given. All the movements of this system are combined in one common centre, which might not improperly be called the concentrator. The system may be said to consist of the particular application of springs and levers, except that the cloth beam is turned by a wheel and pinion, connected to the concentrator by a journal. There are no cranks in the machine. The springs act on players, and are regulated by screws, so that their strength can be increased or diminished at pleasure, according as the nature of the fabric, or the speed at which they are driven, may require. Hence no more power need be given to the parts than merely to overcome the resistance. All its movements are smooth, even to a degree which equals the hand loom. This does not arise from any fineness in the machinery, but from the principle of the machine; the power which acts on it, in consequence of the springs, is of a restrictive kind. This application of machinery is very similar to the human system in the action of weaving. The arm of a weaver acting on the lay, is really a spring and a lever. This loom, from its smoothness of movement, and capability of exact adjustment and regulation, is particularly fitted for fine fabrics, such as fine lawns and jaconets, or silks, such as bandanas, persians, or sarsenets, &c. Were this loom used in weaving the goods woven by the common power-loom, it would be more easy on the yarn than the other; so that the common yarn might be wrought, which would be a great saving. I intend, as soon as convenient, to add a dressing machine, designed to be easier on the yarn than those at present in use. In holding my invention forth to public view, I shall say little concerning it. This, however, is not to be understood as arising from any doubt which I entertain of its usefulness or efficiency; but from the very opposite conviction. I offer it not as the result of chance, but as the offspring of deliberate thought, assisted by experience. I leave the machine to speak for itself, and form its own character.

I am, Gentlemen,
Yours, &c.
George Whyte.

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* We will not have it in our power to insert Mr. Whyte's second drawing with the description till the week after next.

ON FLUES AND STALKS FOR CHIMNIES.

Various methods of consuming smoke have been successfully adopted in England; and, as we have been from time to time stating, some of them might, with great advantage, be adopted here. We, some time ago, gave an account of Mr. Chapman's method, and in our last we gave that practised by Mr. Roberton, either of which we should be glad, and certainly hope soon to see, very generally in use. It is much to be feared, however, that any of the methods of consuming smoke can only be successfully applied to the furnaces of steam engine and evaporating boilers; and that there are a great variety of other furnaces belonging to public works, to which it may be difficult to apply it with advantage.

It appears to us that there has been a great oversight in the first construction of the furnaces of almost all the public works around the town; and that none of them have ever begun upon a proper plan. With a view, probably, to save expense, low vents are built at first, whereby one is required for each furnace; and those vents have always to be added too, as the number of furnaces in these works are increased. The evident consequence of this, and of the public works around having such numbers of these low vents, is, that the smoke and vapour is not carried high enough; but is carried directly into the doors and windows of those who happen to be so unfortunate as to have a house in the neighbourhood of any of them. But not only is such works, so constructed, a nuisance to their unhappy neighbours, but they are really a nuisance to themselves. From the smoke not being carried sufficiently high, when there is not enough of wind to blow it away to trouble others, it falls down upon the other parts of the work—smuts and dirties the goods manufactured in it with soot—injures the health of the workmen—and renders the whole work dirty and noxious in the extreme.

In order to remedy this, if not entirely to remove it, and especially where, from the number of small furnaces, it would be next to impossible to burn the smoke, it is decidedly to be wished that some plan were adopted. We have seen a plan which has been adopted by one or two public works, and which, we think, would, in a great degree, remove the nuisance we have been complaining of. This plan is, instead of erecting a set of low vents for the various furnaces in the work, to erect one large main cone, in some proper and convenient part of it, into which the smoke of any number of furnaces could be carried by under ground flues. We have already said that it was very probably with a view to save expense that the plan of erecting these low vents was at first gone into; but there can be no doubt whatever, that the plan now suggested would, although it might be more expensive at first, come to be much cheaper at the end; because, instead of afterwards being obliged to build a new vent to every new furnace which is erected, were one main cone built at first, the smoke of every additional furnace which might be required, could be carried up it by merely connecting them together by an under ground flue.

It is to be hoped that the obvious utility of this practice will cause it to be universally adopted in the erecting of new works; and we should hope that something may be done to improve the old; and that instead of the whole atmosphere being polluted with smoke issuing from an innumerable quantity of low vents, we shall see all the smoke carried off high into the air, by means of one large main stalk or cone. We wish it to be understood, however, that we by no means urge this in order to supersede burning smoke; on the contrary, we should be extremely glad could this be done in all kinds of furnaces; but even where the smoke is very successfully burned, some may still escape; and it would, therefore, be advisable always to adopt the plan we recommend, of having one main stalk and flues, instead of a number of low vents.

DUNBAR MECHANICS' INSTITUTION.

It was with peculiar interest we noticed the commencement of a Mechanics' Institution in the town of Dunbar—a town which, although not very populous, having but little manufactures, and situated we may say in a corner of the land, has the signal honour of being the birthplace of Rennie, the celebrated engineer; of Nicholson, a first rate mathematician, and the most eminent architectural designer of the present age; and of Meikle, the inventor of the thrashing machine. Since our former notice, the promoters of the Institution have continued their exertions, and, we are glad to perceive, have got it fairly set a-going. Upwards of one hundred and fifty individuals belonging to the town have already become members, and they expect that this number will be considerably increased by the accession of the farmers in the neighbourhood. Mr. Morton is delivering a series of lectures on Natural Philosophy and Chemistry; a class for Mathematics meets twice a-week, under the superintendence of the same gentleman; and a library is rapidly forming with a reading-room attached to it, which we hope will be of benefit to the mechanics. Provost Middlemass, with much honour to himself, in the readiest and kindest manner, has allowed the use of the old mathematical school-room of the town, which is, we understand, both convenient and commodious, to be used as the regular lecture-room and reading-room of the Institution. Mr. Hunter of Thurston, the patron of the Institution, and a gentleman of great wealth and respectability, has hitherto given his personal attendance, not only at the lectures, but even at the Committee meetings,—thus showing the interest which he takes in its prosperity. This shows much good sense and liberality, and should put to shame those whose narrow-sighted policy, or haughty fastidiousness, prevents them giving the sanction of their presence, or the aid of their purse, to an object of so much real utility as popular education. We certainly are sorry to perceive that the Earl of Lauderdale has hitherto taken no notice of, or given any assistance to, the Dunbar Institution, notwithstanding that he is so intimately connected with the town. It was to be expected that a nobleman of his talent and liberal sentiments, would have been prompt to render his assistance. We hope, however, and are inclined to think, that it is unintentional neglect, rather than design, which has caused what we notice, and that he will yet think proper to give them his sanction and assistance. We cannot refrain from mentioning what has come to our knowledge—that Mr. Brougham himself revised the regulations of this Institution, and suggested many useful alterations to the Committee. Such anecdotes as this, if possible, more than his public exertions, show the goodness of heart and desire for the benefit of man, with which this distinguished individual is actuated, and entitle him to the praise and the thanks of all good men. An example of shutting their shops at eight o'clock every evening, to allow their apprentices and shopmen an opportunity of attending the lectures, was set to their townsmen by Mr. David Blair and Mr. Robert Brown, haberdashers, and it has been followed with praiseworthy promptitude by the other shopkeepers of the town. We have been favoured with a copy of the following address, delivered by Mr. Morton at the opening of the Institution, which took place on the 20th September last.

Mr. President,

Sir,—It is impossible for any thing to afford me greater pleasure than the opportunity I now possess of addressing you in the situation you at present hold: for, seated in that chair as Vice-President of this our new-formed Institution, you, and the gentleman you represent, evidently evince yourselves as well the patrons of science as the friends of the mechanic. Nothing, Sir, can be more laudable than the desire to diffuse general knowledge among men; and no branch of knowledge is more worthy of study and attention than that which is now particularly to be the object of our attention—Natural Philosophy. Indeed, the advantages to be derived from a knowledge of this science are so great and so universally admitted, that, we presume, no individual, or society of individuals, will be held to deserve ill of the republic of letters who shall endeavour to diffuse more extensively the knowledge of it, or to render the attainment of it more easy; for, as without a knowledge of this science a number of others cannot be so fully understood, so there are none which impress more pleasing ideas on the mind, or afford it a more rational and delightful entertainment.

Philosophy is not a dry study, as some may suppose, but is a pursuit not merely of the highest utility, but capable of affording amusement, intellectual as it is inexhaustible. Those who cultivate it well know that it naturally produces a sincere and disinterested love of truth, an enlarged view of nature; that it destroys the effects of prejudice, presents the most correct ideas of the great original cause, and promotes a detestation of every thing mean or base. If, then, there be a pleasure in attending to objects which fill the mind by their immensity, and delight the imagination by the discovery of new and sublime analogies, it is not to be wondered at that philosophers should pursue their studies with so much laborious zeal and attention. Philosophy, Sir, is the investigation of the truth, from those principles, peculiar and proper to itself, and from no other; and these principles must not be taken up at venture, or formed upon supposition, but must be sought for and found by much experience and observation on the nature and constitution of things themselves. The end of natural philosophy is to increase the knowledge and the powers of man, and enable him to understand the ways and procedure of nature. By discovering the laws of nature, he acquires knowledge and obtains power: for when these laws are discovered, he can use them as rules of practice to equal, subdue, or even excel nature by art; upon the discovery of these laws, then, depends the perfection of philosophy and the enlargement of human knowledge and power. Our first motions are directed by instinct to the study of nature—to feel, taste, hear, see, and smell every thing that comes in our way, are our first beginnings in experimental philosophy, and we thus lay the foundation for a knowledge of nature and her laws.

When the nurse supposes the infant in her arms to be only amusing itself by striving to catch at every object within its reach, it is amassing a stock of important information; and by this natural propensity it is we learn to know distances, hardness, softness, those objects which afford pleasure and pain, heat, cold, and many other qualities of bodies, long before the acquisition of any knowledge could be suspected by the unobserving part of mankind. The soul of man being thus prompted by nature to satisfy an insatiable curiosity, we are solicitous after every species of information, even in earliest youth, and it would be extremely unnatural to suppose we should be less inquisitive as we grow older, less solicitous after such important truths as the knowledge of nature and her laws. Indeed, we can scarcely think it possible that any rational creature can be unconcerned to know the state of the world around him, or to behold the various phenomena which for ever present themselves to his observation, without being strongly prompted to inquire into their cause and their nature, and although those who wish to continue the reign of ignorance among mankind have often branded philosophy as being the cause of mischief, yet the wise and virtuous well know that there is no science whatever better calculated to fill the mind with all good and kind dispositions, and the head with every valuable and useful acquirement. No science whatever, which points out a more direct or rational path to a knowledge of our duty; none which more withdraws the mind from narrow and contracted prejudices, or so supplies it with sublime and lofty speculations.—False schemes of philosophy may lead to atheism, or suggest opinions of the most dangerous consequences to mankind; but true philosophy will lead us to believe in and adore the Supreme Being; and, as it continually exhibits brighter and brighter instances of his wisdom and power, it removes also in part that veil which, spread over nature, conceals from our view its awful depths, its majestic truths, thus enabling us to see the glories of the Almighty shining in exalted creation, and thence instructing us to raise our voice in praise to him who is alone worthy to receive glory, and honour, and power; for it is by him that all things were created, and by him they are continually preserved. That one great and universal mind who made all things by his power and preserves them by his goodness, is the first and only cause operating at all times and in all places, and producing, by an exertion of his will, all the various phenomena of the material system, is a truth which cannot be called in question. This first and universal cause, however, in the ordinary administration of his providence, hath condescended to employ second causes as the instruments of his will; by these he acts, and these second causes he has also appointed to operate through every part of his creation, by general and invariable laws. To trace the hand of the Almighty through all his works, to investigate these second causes, and erect them into general laws, is the sublime, the exalted employment of the natural philosopher. To explain, therefore, with certainty, the phenomena of nature, to remove their obscurity, and observe their influence and connection, is the great business of philosophy; and for this purpose, the observer must obtain certain fixed points that may serve as landmarks by which he may guide himself in the difficult journey he has undertaken, and prevent his wandering too far from the proper path.

From natural philosophy we learn that the creation is but an image—a picture of the Divine perfection, and therefore, bears a character of his infinity; that this small part of it which we inhabit is but a point in comparison of the solar system; that the solar system is but a point in comparison of the vast regions of the fixed stars; that these superior regions themselves, are but a point in comparison of the innumerable worlds that lie hid in the bosom of immensity, and that of this point which we inhabit, we know only some superficial qualities and properties. Sir Isaac Newton said, all the discoveries that mortals can make are like those of a child upon the borders of the sea, who has only broken some peebles or opened some shells to see what is in them, while there lies beyond him a boundless ocean, of which he has no idea; and that we never can be true philosophers till we see the author of nature face to face, compare the picture with the original, and know by direct intuition their mutual relation and resemblance. Lord Bacon terms natural philosophy the great mother of the sciences, for, says he, "neither the arts of speech, logic, medicine, civil policy, morality, &c. can be advantageously exercised, improved, understood, or instituted without it, and all the mechanical sciences depend upon it." Pythagoras, who was one of the most learned men of antiquity, who travelled over all the eastern countries, and stored his mind with all the hidden treasures of oriental knowledge, who, according to Cicero, crossed many seas, travelled on foot through many barbarous nations, spared no labour either of body or mind, in order to acquire useful knowledge of every kind, when he presented himself for the first time to the admiring eyes of Greece assembled at the Olympic games,—a spectacle, no doubt, for universal admiration and respect,—with an understanding so enriched and full in its meridian vigour, making him an object that his cotemporaries might look at with a veneration little short of idolatry: when Pythagoras, in this attitude, surrounded by the Grecian sages in the field of the Olympic games, whilst every eye was fixed on one of the most perfect forms in nature, began to pour forth the wisdom of his doctrine, astonishment seized the hearers, and, almost doubting if it had been a mortal that was discoursing, they with one voice demanded by what title he would be addressed. Pythagoras answered, that their seven sages had taken the name of wise men; for his part he left them in possession of a distinction they so well merited, he wished to be no otherwise described or remembered than as a lover of wisdom, his pretensions did not go to the possession of it, and if they would call him a philosopher, he would be contented with the appellation. From that time the name philosopher became a title among the learned. We see, then, that this great man was so conscious of the difficulty of attaining truth, that he would not allow himself to be called one of the magii, one of those ostentatious names which the learned in his day took upon themselves; "No," said he, "I am a philosopher, that is to say, I am a lover of, and an inquirer after wisdom, rather than one really possessed of it."

Now, Sir, my intention is to direct the minds of the members of this Institution, first, to Astronomy, and we believe we could not have made a better choice, for the study of Astronomy is at once instructive and delightful. No science is so eminently adapted to elevate, to expand, or to ameliorate the soul; for, in contemplating the vast fabric and structure of the universe, we are naturally led to meditate upon its great author and preserver, by which we acquire notions of him more comprehensive and better suited to his attributes, and, what is of no small moment, we also more justly learn to appreciate our own. We are taught to consider ourselves as a part of one great family, whose common parent and benefactor is the impartial and omnipotent God. Hence pride, the source of all evils, which continually infests mankind, (and what is man that he should feel pride in aught?) is exposed and put to shame in the light which Astronomy produces: how truly worthy to a rational and responsible being, then, is the study of this sublime science!

I, secondly, intend to turn their attention to Mechanics, with which I would advise every operative to be thoroughly acquainted. Thirdly, to Optics, or the laws of light and vision. Fourthly, to Pneumatics, or the doctrine of air—its gravity, weight, and pressure. Fifthly, Magnetism, or the properties of the loadstone. Sixthly, Electricity and Galvanism. Seventhly, Hydrostatics and Hydraulics. And last of all, to Chemistry, as being the most useful and most extensive branch of philosophy.

The knowledge of nature may be divided into three periods. The first is that in which the attention of man is occupied in learning the external forms and characters of objects, and this is called Natural History. In the second, they consider the effects of bodies acting on each other by their mechanical power, as their weight and motion, and this constitutes the science of Natural Philosophy. The third is that in which the properties and natural action of the elementary parts of bodies are investigated; this last is the science of Chemistry, and I have no doubt you will agree with me in thinking it the most interesting.

Such, Sir, is the method I intend to pursue in the course of lectures that is to follow. But, Sir, I would strongly recommend the young men to form themselves into a mathematical class, in order that they may be taught the principles of this noble science, for, without a knowledge of mathematics, you know well no proficiency can be made in the various branches of natural philosophy, particularly in these useful branches, astronomy, mechanics, and optics: indeed, without a previous knowledge of mathematics, many of the illustrations and experiments would be of little more avail than mere childish amusements, although such experiments might serve to develope the most important truths in the science.

But, Sir, if, under your and your representative's patronage, this Institution shall prosper, I hope in a short time we shall perceive a wonderful change in the morals and manners of our mechanics, and, without laying claim to any spirit of prophecy, may I be allowed to say, that we shall, in part, experience that golden age so much fabled by the poets. Instead of seeing the toiling mechanic, after retiring from his labour, spending the evening with debauched companions, in frequenting the taverns or ale houses, ruining his family, grieving his partner in life, and destroying his health by the immoderate use of spirituous liquors, we shall see one busily employed in grinding lenses for a pair of spectacles, and describing, in a philosophical manner, what kinds of them are best suited to different eyes, and when and how it is necessary to use them, in order to repair decayed sight; we shall see another throng in preparing glasses for a microscope; and a third polishing the speculum of a reflecting telescope, learnedly telling his neighbour the best compositions for reflecting, and how to give them the true parabolic form; a fourth, instead of trifling away precious time in slumbering before the fire, with the bowel of a tobacco pipe and small pieces of coal, shall show his children the nature of gas, and explain to them its various properties. Instead of standing at the corners of the streets, and spending time in idle and wicked conversation, we shall see them pointing out the different constellations with which the heavens are adorned, explaining the moon's influence upon the earth, and how the tides are produced. Such, Sir, I trust, will be some of the happy effects produced by the Dunbar Mechanics' Institution, and that through nature's works they will look up to nature's God.

That these ideas may be realized for your honour and the mechanics' happiness and comfort for time and eternity, is my sincere wish.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION VII.

Chlorine and its compounds.

Next to oxygen, chlorine is perhaps the most interesting of all chemical agents. The theoretical researches to which it has given rise, are the most profound and the least satisfactory of all the subjects of chemistry. With these at present we have nothing to do; but we shall find its use in manufactures, and chiefly in bleaching, no less interesting, and surely more important than the ingenious theoretical discussions which it has produced. This substance has been called an acid, but it wants one of the most marked properties of this class of bodies, namely, the conversion of vegetable blues to red. Chlorine dissolves all vegetable colours, and renders them white; hence its use in bleaching, and its distinction from all other acids. In the gaseous form, it is of a greenish yellow colour—whence its name; and, although it supports combustion, cannot be respired without great injury to animal life. For the purposes of bleaching, it is made by an apparatus invented by Berthollet, and subsequently improved by Des Charmes, Fisher, and others. A description of the latest improvements in this apparatus has already been given. I shall now briefly state the process. The black oxide of manganese and muriate of soda, are mixed together in the proportion of 2 to 3, and after moistening them with water, they are wrought till the mixture is of the consistence of moist dough, in order that the manganese may unite more intimately with the salt. The mixture is perfect when it is uniformly black. In this state they are put into the retort. There is now gradually added $2\frac{4}{7}$ parts of sulphuric acid, which has previously been diluted with its own weight of water, and allowed to cool, in order to prevent accidents. This immediately, without the application of heat, disengages chlorine from the mixture in the state of gas; as soon as the quantity of gas thus disengaged diminishes, a fire is kindled under the water-bath in which the retort is placed, and continued till all the procurable gas come over. This gas, impelled by its expansive force, passes from the retort to the large leaden receiver, where it is combined with water, with lime, or with some of the alkalies. The rationale of this process is, that the sulphuric acid having a greater affinity than muriatic acid for the soda of the muriate, combines with the soda, and sets free the muriatic acid, which, according to Davy, parts with its hydrogen to the manganese; according to the old theory, it attracts the oxygen of the manganese, forming chlorine gas. This gas it was which was formerly used in bleaching, pure and without admixture, but this is now, I believe, wholly laid aside, and a combination of it with water, potash, soda, magnesia, or lime, is preferred. These it will be necessary to discuss in their order.

1. *Berthollet's Bleaching Liquor.*

The chlorine diffused through water was the mode of using it invented by Berthollet, and still followed in some old establishments. The bleaching liquor formed in this way may be either made of the proper strength for use at first, or it may be made stronger and more concentrated by putting in a smaller quantity of water into the receiver, or a larger proportion of ingredients into the retort; in which case it can be afterwards diluted to the proper strength. When this liquor is much concentrated, it has, like the gas, a greenish yellow colour, or what Werner calls a siskin green. It has also, like the gas, a very penetrating and offensive smell, arising, indeed, from the disengagement of the gas. It cannot be breathed, even for a few instants, without the danger of a most obstinate and violent cough, and sometimes causes the workmen to fall down senseless. Asthmatic affection of the breast, headache, tears and smarting of the eyes, bleeding at the nose, pains in the small of the back, and spitting of blood, are the ordinary symptoms which its respiration induces. So that unless the most careful and unremitting attention be paid to the lutes, it is impossible even for a strong man to support, for several successive days, so unhealthful an employment. Des Charmes (p. 65) was so much affected by the violent expectoration thus produced, that he could retain no food on his stomach; he was deprived of sleep, and exceedingly afflicted with acrid humours flowing from his nose and eyes, so that he could not bear the light, while he suffered great pain in his back and thighs. Those consequences are very serious, and they soon called forth the genius of invention to contrive preventives.—One of these was to introduce carbonate of potash or soda into the water in the receiver, in the proportion of one-fourth to one of the muriate of soda employed. Even the sprinkling of a solution of any of those carbonates upon the surface of the bleaching liquor, previously to using it, will, in a great measure, neutralize the disagreeable effluvia. By this method, however, the alkali was not only totally lost, and the expense in consequence greatly increased, but the detergent power of the liquid was supposed to be considerably diminished, which was attempted to be proved by Mr. Rupp of Manchester, from numerous experiments. To obviate the primary evil, and to avoid the expense of its proposed cure, he contrived a very simple apparatus for exposing the goods equally to the liquid, and preventing the escape of the noxious gas, a description of which has already been given in its proper place. The application of chlorine condensed in water, however, may now be considered as one of the nearly obsolete agents in bleaching, although it is unquestionably more powerful than any of the oxymuriates.

ON THE CONSTRUCTION OF ÆOLIAN HARPS.

[Continued from p. 139 of the present Volume.]

I SHALL next proceed to the tuning. First stretch the bass string to any pitch you may prefer; generally speaking, I would say to that of low G, on the flute gamut; and it is best to always retain one standard, taken from any instrument at command. Having this key-note, the remainder may be merely mechanical, the ear not being required, for the eye is fully competent. Your readers, not knowing the fact, may be informed, that if, of two strings in unison, one be vibrated, the other will instantly and spontaneously vibrate also; but if not in unison, the second will remain quiescent. So, several strings nearly adjacent, some being in unison, the others not, if one of the former be vibrated, all those in unison will vibrate; but the latter, though intermediate, alternate, or however relatively placed, will be motionless. And if one out of unison be vibrated, all the remainder will be inactive. In tuning, then, we have nothing more to do than to gradually increase the tension, until the eye can perceive the chord to vibrate fully when the key-string be sounded. But this is not the best of all methods; it is that hitherto used, only having all the strings toned alike. The following, which I have long used, is far superior, as eliciting the fullest powers of the instrument. Take the bass string as the standard pitch, then extend every alternate string into an octave above the bass, and let all the intermediate ones bear unison with the bass. The effect will be sensibly improved. But should the harp be short, and the length of its strings, of course, limited within diminished oscillation, the higher notes would be apt to run into a shrill scream; to obviate which, the original pitch of the key-string must be proportionally lower, leaving a latitude of play for the higher vibrations, and modifying the influence of a too sudden or too rapid breeze. Still I have found the effect augmented by obtaining octaves both above and below the key-string. Suppose there be eight strings, including the bass, the second and fourth from it must be carried into superior octaves, the third and sixth into inferior octaves, and the first, fifth, and seventh into unison with the bass. It is obvious that this harp must be rather long; it should be between three and four feet, to admit of oscillatory scope for the octaves above and below the bass.

Hitherto I have spoken of the harp as commonly constructed with the bass string on the outside of the plane of strings; but having tried, I would strenuously urge the placing of the bass in the middle, and having an equal number of common strings on each side of it. There must necessarily be an odd number of strings, and the most convenient plan will be three common ones on each side, with the bass in the middle, making seven in all, or four common ones on each side, making nine. When octaves above and below are required in this form, (and I would never omit them,) they should always be on alternate strings, so as to avoid a similarity of tension in contiguous ones; therefore, they must not all be of similar character on the same side; and it is of consequence that, be the octaves placed how they may, some of them should be in unison with the bass. If they all were carried into superior or inferior octaves, the effect would not be nearly so full, the tones so rich, or the cadences so complete. The specific advantages of this form are, that, without complicating the instrument, there arises a variety of accordance in the swells, and it seems also to adapt itself better to the varying intensity of aerial undulation. Next, as to the degree of tension, I would observe, that it is scarcely possible to lay down any specific rule, whereby an amateur can govern his practice; for so many circumstances may influence the operation of the harp, under any given intensity of tension in the strings, as to render it impracticable to meet their separate or combined effect, by instructions that could be detailed within a moderate compass. This point, however, is in some degree met by my remarks respecting the stringing; because, if we take the bass at a certain and known gamut pitch, and give all the other strings their due concords and octaves, we have almost all that is wanted. It must be understood, that although the harp may be well strung and tuned when set to play, yet it may soon cease to issue forth its enchanting tones; or they may not succeed each other so as to sustain a succession of melody, or may not form the cadences with effect; and all this because a change may have taken place in the condition of the strings, or in the strength of the aerial undulations. For if they be subject to be acted upon by the moisture or dryness of the atmosphere, and to that add the heat of the sun, a very few minutes will suffice to throw the best tuned instrument into discordance. Therefore, as before enjoined, the catgut strings must be well resined. On the other hand, if the wind be too strong for the tension of the strings, the aerial impulses will strike in such rapid succession as to terminate each oscillation before it can complete a distinctly prolonged tone, and so produce a screaming sound, or prevent sound altogether. Now, as we cannot calculate on a particular force of impulse, nor devise any varying intensity of tension, to meet the fluctuating strength of undulation, we must endeavour to control the current itself, so as to adapt it to the existing condition of the instrument. To this purpose we must elevate the sash, and thereby diminish the pressure of the air on the plane of the strings, and close the door of the apartment, as well as open as many of the windows on that side of the house as we can command. We may also remove the harp a little within or without the perpendicular plane of the sash. If all these means fail, the bass string must be slackened, and all the others be brought into a renewed tuning. This, I believe, is all that can be done; and I may add that, be the harp strung how it may, it will seldom play well in a strong current. In a calm atmosphere we can usually act with a better effect; for the harp pours forth its finest tones in a current barely perceptible. But if art be necessary to obtain even this slight power of impulse, the sash must be first lowered a little, the door of the apartment and the windows on the opposite aspect of the house be thrown open, while all those on the same side of the house should be closed. By these means we shall turn the stream of draught through the aperture occupied by the harp; or should they really fail, the only remaining resource will be in slightly increasing the tension of the strings, provided they were previously lax.

I have alluded to a simple means which I have used to augment the sweep of the aerial current over the plane of strings, and with success. It consists in placing a board, by screw, under the sash, so that it shall form a plane parallel with the upper surface of the harp. This in some degree resembles the superior plane of the harp, when fitted for the open air, and was indeed suggested by it; but mine is broader, the breadth being three times that of the harp, and is an excellent aid when the window current is weak. The harps for the open air, as usually constructed, have their practical limits, as well as those for window apertures; for their dimensions should never much exceed four feet, nor six inches in width, with five in depth. The number of strings may be the same as already recommended for the others, and if thrown into the graduating form so much the better. Catgut strings cannot bear continued extension to a sufficient degree, if they exceed four, or, at the utmost, four and a half feet; for they will speedily lose their concords. They should bear upper and lower octaves, with unison strings, and have the bass in the middle. The plane that is placed over them should be moveable, with reference both to its perpendicular elevation and angular bearing with the plane of the strings, so that the aerial current may be as governable as possible. The scattered information that is to be met with in Kircher, who was the inventor of the Æolian harp, and in the larger Encyclopedias, as the Britannica and Rees', is defective; and it were to be wished that some profound scientific amateur would devote attention to an instrument whose melodious powers are so truly enchanting. P. H.

RECTIFICATION OF SOME POPULAR ERRORS REGARDING THE SHARK.

Whatever may be said of the matter, the true Shark, *Squalus Carcharias*, appears to us to inhabit almost every sea. It frequents the Atlantic Ocean, the Mediterranean, the shores of India, the Moluccas, the seas of New Holland, and those of the Archipelagos of the Pacific Ocean. In all these places, we have compared the species with one another, and we have every where found a perfect resemblance of forms. This animal is naturally slow in its motions, and we have never seen in it the vivacity of certain other fishes, even after it had been slightly wounded. This latter circumstance leads us to remark, either that its sensibility is much altered, or rather that the imperious feeling of hunger predominates over the pain; for it is seen returning to bite and be caught by the hook which had torn it. Its voracity is extreme in certain cases, in others it does not exist, without our being able to account for the circumstance. We have seen sharks swim round the vessel for whole days, refuse for a long time the flesh that was presented to them, at length take it, and on being opened have nothing in their digestive canal. It has been said that they have the faculty of springing out of the water, in order to seize their prey; we have never, however, remarked it. A story is told of a seaman, who, while bathing, was pursued by one of these ferocious animals: on hearing his cries, a rope was thrown out to him, which he got hold of; and scarcely had he left the surface of the water, when the furious animal sprung at him, and carried off one of his legs. We shall stop to contradict this account, because it is evidently at variance with all that we know of the motions which the organization of sharks can allow them. From the position of their throat, in the middle of, or beneath, a long snout, they can only lay hold of their prey, by turning upon one side or upon their back. Now, we ask, could this animal, in a position so unfavourable, spring up, by raising a considerable mass of water, which weighs not only upon its body, but also upon its large pectoral fins, whose constantly horizontal direction is one of the greatest obstacles to the faculty which it is alleged to possess of bounding out of the water? Not satisfied with mere reasoning on the subject, we had several times recourse to experiment, and it was always in vain that we presented to the most famished shark, a bait at six inches distance from the surface of the water; it left it without making the slightest attempt to get at it. These fishes never have the body and head above the level of the sea; all that they can do is to show the extremity of the dorsal fin: sometimes, but rarely, the upper lobe of that of the tail. It is even by the former sign, that, in a calm, its approach is discovered at a distance. We also think, that too much has been attributed to the power of its jaws, and the cutting action of its teeth. It is certain that no fish has sharper ones; but if we consider their very oblique position, which render some of them parallel to the axis of the body, and the manner in which they act with relation to one another; if we examine the mechanism of the jaws, which, as they do not correspond, cannot possibly furnish a point of support to each other, we shall see that they do not act perpendicularly upon the body to be divided, and that they cannot cut it fairly, if it be very strong, as a bone for example. We therefore consider as exaggerated what is told us of men cut in two, or who have had their legs carried off; facts of this sort would require to be well attested. All these rows of crenulated teeth directed toward the posterior part, appear more especially destined to tear and to overcome the efforts of a victim still living in the gulf which has swallowed it up. The Squali could only break and dismember a man, when there were several of them pulling in contrary directions. It was thus that our unfortunate companion Robinet met his death, in a truly horrible manner at Cayenne; for, bathing imprudently in an exposed situation, he was carried off, and devoured by these monsters. On the following day his limbs were found scattered upon the beach. We imagine their sense of smell to be very highly developed. The delicacy, however, does not lead them to follow ships in which there are sick people, as the sailors allege. They never appear but in calms; and, however little the sails are filled, they are soon left behind. It would be a waste of time to expose all the puerilities connected with the subject of sharks. Many seafaring people still have their imagination filled with those marvellous accounts which the first navigators gave of every thing that struck their attention in distant countries.—*Quoy and Gaimard, in Annales des Sc. Nat. for Dec.* 1824.

GENERAL REMARKS ON THE TEMPERATURE OF THE TERRESTRIAL GLOBE, AND OF THE PLANETARY SPACES.

By M. Le Baron Fourier.

M. Fourier's interesting memoir on the temperature of the globe, presents a review of all his inquiries on the subject, and is to be considered as exhibiting the present state of our knowledge regarding a matter of much interest to the geologist, as well as to the natural philosopher. It may be even said that the question of the proper temperature of the globe, and of the changes which it may have undergone at the surface, forms one of the most important bases of geological knowledge. Under this point of view, we are happy in being at last able to support, by learned mathematical theories, which are only the expression of observed facts, the opinions which we have long held out on the subject of the depression which the temperature of the surface of the earth has experienced,—a change to which we have attributed the modifications which life has undergone at this surface, by proclaiming the return to the principal geological opinions of Buffon as inevitable. The heat of the earth, according to the learned academician, is derived from three sources: 1*st*, The earth is heated by the solar rays, the unequal distribution of which produces the diversity of climates; 2*dly*, It participates of the common temperature of the planetary spaces, being exposed to the irradiation of the innumerable stars which surround on all sides the solar system; 3*dly*, The earth has preserved in the interior of its mass a part of the original heat which it contained when the planets were formed. M. Fourier then examines separately each of these three causes, and the phenomena which it produces. We shall only relate here the considerations which are most important with regard to geology. The opinion of an internal fire, says M. Fourier, the perpetual cause of several great phenomena, has been renewed in all the ages of philosophy. The form of the terrestrial spheroid, the regular disposition of the internal strata, rendered manifest by the experiments of the pendulum, their density increasing with the depth, and various other considerations, concur to prove that a very intense heat has formerly penetrated all parts of the globe. This heat is dissipated by the irradiation into the surrounding space, the temperature of which is much inferior to that of freezing water. Now, the mathematical expression of the law of refrigeration shows, that the original heat contained in a spherical mass of equal dimensions with the earth, diminishes much more rapidly at the surface than in the parts situated at a great depth. These preserve almost all their heat during an immense time; and there is no doubt regarding the truth of the consequences, because we have calculated these times for metallic substances, which are better conductors of heat than the matters of which the globe consists. But it is evident that theory alone cannot inform us what are the laws to which the phenomena are subjected. There remains to examine, if, in the strata of the globe to which we can penetrate, there is found any indication of this central heat. It would require to be proved, for example, whether, beneath the surface, at distances at which the diurnal and annual variations have entirely ceased, the temperatures of the points of a vertical line prolonged into the solid earth, augment with the depth. Now, all the observations which have been collected and discussed by the most learned naturalists of our days, show that this increase does exist; it has been estimated at about a degree for 30 or 40 metres. The experiments with which the Academy have lately been furnished, and which relate to the heat of springs, confirm the results previously obtained. It is easy to conclude, and it results, besides, from an accurate analysis, M. Fourier says, that the increase of the temperature in the direction of the depth cannot be produced by the prolonged action of the rays of the sun. The heat which emanates from this star is accumulated in the interior of the globe; but the progress has almost entirely ceased; and if the accumulation still continued, we should observe the increase in a direction precisely the contrary of that which we have indicated. The cause which produces a higher temperature in the deeper beds is, therefore, an internal source of constant or variable heat, placed beneath points of the globe to which we have penetrated. This cause raises the temperature of the earth's surface above the value which the action of the sun alone would give it. But this excess of the temperature of the surface has become almost insensible; and we are assured of it, because there exists a mathematical relation between the value of the increase by measure, and the quantity by which the temperature of the surface still exceeds that which would take place, if the internal cause in question did not exist. It is the same thing for us to measure the increase by units of depth, or to measure the excess of temperature of the surface. When we examine attentively, and according to the principles of dynamic theories, all the observations relative to the figure of the earth, we cannot doubt that this planet had received a very elevated temperature at its origin; and, on the other hand, thermometrical observations show that the actual distribution of heat in the earth's envelope, is precisely that which would have taken place if the globe had been formed in a medium of a very high temperature, and had afterwards been constantly cooled. This accordance of the two kinds of observations is worthy of being remarked. The question of the terrestrial temperature has always appeared to us, adds M. Fourier, one of the greatest objects in cosmological studies; and we have had it chiefly in view in establishing the mathematical theory of heat.—*Bulletin Universal.*

QUERIES.

Gentlemen,—What is the reason that a *new* pot requires to be kept till it be *old*, before it can be satisfactorily used? My wife lately bought a new "*kail pot*," and for the life of her can she make the broth otherwise than "*as black as soot.*" She has tried every ordinary method to remedy this—made it red hot; burned peats in it; fumigated it with brimstone; and, in short, done every thing which the experience or sagacity of her neighbours could devise, but all to no purpose. It seems it must be *old* before it can be used. Now, Mr. Editor, this is very strange; and as I love a plateful of nice white broth, I should like some of your culinary Correspondents would take up the matter, and discuss it *a-la-Kitchener*, and so conduce to the comfort of

Yours, &c.

An ADMIRER.

Duke-Street, 27th October, 1825.

WHAT is the best method of japanning or varnishing white wood work, such as dressing or work boxes, and how is such japan or varnish prepared?

A CONSTANT READER.

GENTLEMEN,—Could any of your numerous Correspondents inform me of the best method for cleaning scarlet cloth when soiled with grease or the like? This may at first sight appear trifling, but when informed that many people in London make a profession of this, it will not appear so trivial.

Yours, &c.

A READER.

Horse Barracks, 3d Oct. 1825.

MISCELLANIES.

Boracic Acid in Lava.—According to Moricand, in the Æolian Isles, boracic acid assists in rendering the lavas more easily fusible. Do the lavas and obsidian of Lipari really contain boracic acid? The greenstone of Salisbury Craigs in this neighbourhood, contains Humboldite, a mineral rich in boracic acid. Does the mass of the greenstone rock contain any of this curious substance?—*Edin. Journal.*

Useful Plough.—A farmer in Moravia has just invented a new plough, which, although drawn by only one horse, produces four furrows. The Agricultural Society of that country has presented him with a gold medal.

Improved Plane.—The Society of Arts has rewarded an ingenious carpenter, named Gladwin, for the invention of a plane, which he has constructed so as to answer all the purposes of the jack plane, the pannel plane, the smoothing plane, and the moulding plane.

A Burmese Philosopher.—The semi-atheistical sects appear to be numerous in the Burman empire. The following character of the acknowledged head of all the semi-atheists in the country is thus given by an American Missionary:—" Like the rest of the sect, Mount Long is, in reality, a complete sceptic, scarcely believing his own existence. They say he is always quarrelling with his wife on some metaphysical point. For instance: if she says, ' The rice is ready;' he will reply, ' Rice! what is rice? Is it matter, or spirit? Is it an idea, or is it nonentity?' Perhaps she will say, ' It is matter;' and he will reply, ' Well, wife, and what is matter? Are you sure there is such a thing in existence, or are you merely subject to a delusion of the senses.' "

If each bag of cotton wool imported into the country this year be valued at £10 a bag, then the value will amount to upwards of £7,000,000 sterling money.

Common wafers strewed upon the floor at night, will be found to be the most cleanly and efficacious mode of destroying that species of beetle which is known by the name of black-clock.

NOTICES TO CORRESPONDENTS

J. M. P., Bookworm, An Enquirer, A. B., A Correspondent, have been received. We should be very glad that some of our Dunbar Correspondents would send us any anecdotes they can collect of the life of Meikle, the inventor of the Thrashing Machine. The report of the Haddington Mechanics' Institution in our next.

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THE GLASGOW
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

> "Cased in thy iron walls, thou far-famed bell,
> My faith in thee, O Art, all fears dispel;
> I with undaunted heart the scene survey—
> Behold the finny brood in gambols play!"

No. XCIX. *Saturday*, 12*th November*, 1825. Price 3*d.*

PORT-PATRICK DIVING-BELL.

Fig. 2.

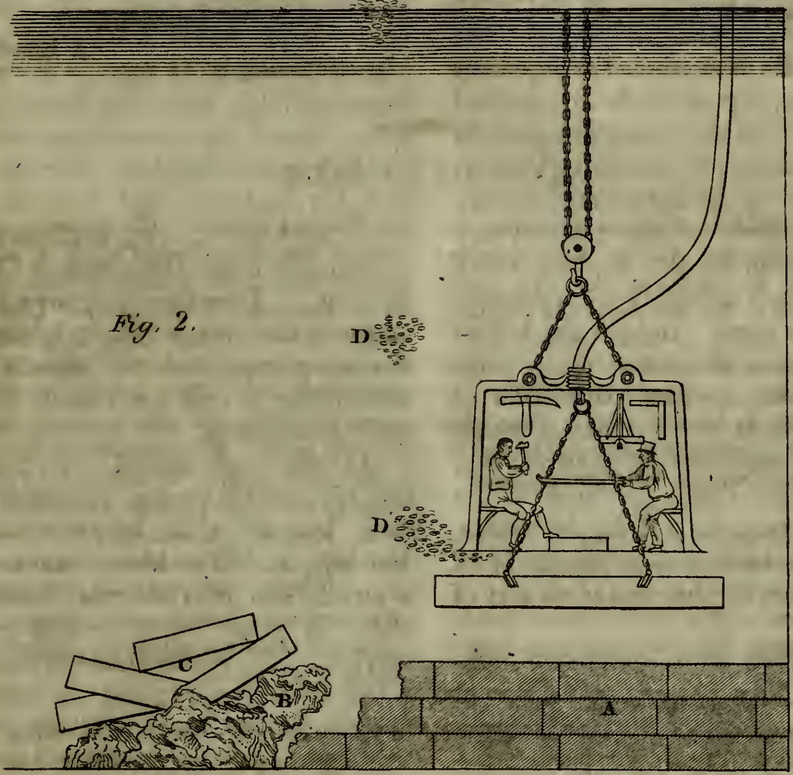
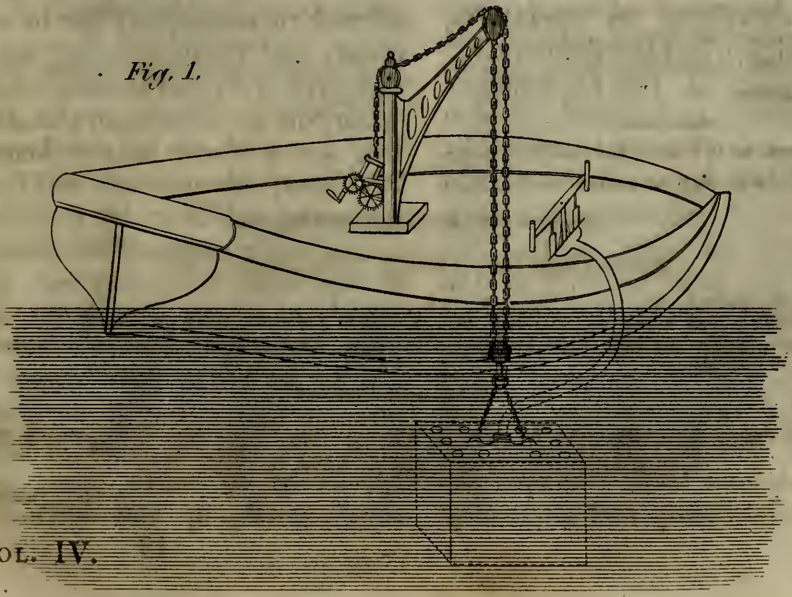


Fig. 1.



—— Swan Sc ——

AN ACCOUNT OF A DESCENT IN THE DIVING-BELL AT PORT-PATRICK.—By Mr. ANDREW LIDDELL.

Read before the Glasgow Philosophical Society, 3d October, 1825.

[Communicated by the Author.]

THE diving-bells of last century, constructed by Halley and by Spalding, are now superseded by the improved ones of Mr. Smeaton and of Messrs. Renny:—that of Smeaton, as used at Ramsgate; and Messrs. Renny's, as at Houth and Port-Patrick harbours. The diving-bell of former times either had no supply of fresh air, or had its supply by the uncertain process of transmission by means of barrels; and it is to Smeaton and Renny that the divers of the present day are indebted for the application of the air-pump to supply the consumption of oxygen. Indeed the bell of former times was but a toy in comparison with the improved bells of the present day; by means of which the diver may now go to any depth, and remain down as long as he chooses; now he builds, he plants, he mines, he blasts, with nearly as much ease in the water as out of it.

Knowing that extensive submarine buildings were going on at Port-Patrick, and that the diving-bell acted a prominent part, I determined, last August, to spend a day in examining its operations, about which I had heard so much.

On my arrival, my expectations were more than realized. I saw upwards of five hundred busy workmen. This great number of human beings were concentrated into a small area, bounded on the one hand by the solid masonry of the pier erected, and on the other by the rocky cliffs, which await their turn to be dashed into pieces, and superseded by another pier of equal strength. In the distance, about 1000 feet from land, was seen the diving-bell, silently and effectually performing its part of this great undertaking.

On my inquiring at one of the workmen for Mr. Foote, the master diver, to whom I had a letter of introduction, I was archly told that he was exactly eighteen feet under water, and that I might *walk* to him if I could. I, however, preferred *sailing*, and soon found myself on board the vessel from which the bell was suspended. Mr. Foote and his assistant had been more than two hours down; and were to be brought up in the course of half an hour. This time I spent in examining the vessels, the machinery, the air-pump, and the signals by which the divers so readily give their commands.

At the time stated, Mr. Foote and his assistant were elevated. I then learned that he was from Paisley; and that his assistant was a sturdy son of Hibernia; both of them in good health and in good spirits. Mr. Foote promptly complied with my request to explain the machinery, and the blasting and mining apparatus, which are all most wonderful. He also kindly offered to accompany me in a descent; and fortunately for me the day was very favourable; not a wave was to be seen in the Atlantic, nor a cloud in the heavens. Mr. Foote, his assistant, and I, took our seats, and down we went, until within a few inches of the masonry, at the depth of twenty feet, when the signal to stop was given. After examining the work, which appeared to be as well jointed and straight built as any I ever saw on land, the signals were given respectively to move east, west, south, north, up and down. We were then, as if by magic, traversed backwards and forwards, upwards and downwards; at one time standing or walking on the mason-work; at another dipping towards its foundation, a further distance of sixteen feet. While thus employed, I thought of my friends, and drank their good health; and having plenty of light, I wrote a letter to one of them, dated from the bottom of St. George's Channel, stating how I felt, and what I had seen. After having been down for half an hour, and my curiosity being completely gratified, the signal to ascend was given, and in five minutes I was again on board the vessel, when I took notes of what I had seen, and what I was told.

The vessel from which the bell is suspended, is an old coaster of about 80 tons burthen, is moored with 4 anchors, has an iron crane similar to those used in luggage boats, with a triple hand power, a double-barrelled air-pump, with $8\frac{1}{2}$ inch cylinders. The bell is of iron, cast in one piece, solid on all sides, except the bottom; the corners a little rounded; the form is oblong, being 6 feet long, 4 feet wide, and $5\frac{1}{2}$ feet high. In the top, there is inserted 10 lenses, (bull's eyes,) 7 inches diameter. To prevent the bell from rolling when in the act of dipping, the bottom edge is heaviest. At this point, it is nearly 4 inches thick, with a gradual taper to the top, where it is about 2 inches thick. It weighs about 4 tons, and is attached to the crane by two chains strongly bolted into the top.* To the inside is fixed wooden framing, with two seats across the ends; also shelves and hooks for the workmen's tools. The bottom is entirely open, with the exception of a foot-board about 6 inches broad. Fresh air is introduced at the top, expelling at the same time a similar volume of vitiated air from the bottom, which ascends to the surface, and frequently with a great noise.† Attached to the orifice, for introducing fresh air, is an internal leather valve, similar to that of an air-pump, which serves the double purpose of diverging the fresh air as it enters, and of closing itself in the event of any accident occurring to the leather pipes; 10 strokes of the pump is in general sufficient. At the depth of 20 feet, 2 men can work it; but when at 40 feet deep, six men are required. The leather pipes, or hose, as they are called, are the same as those used in fire extinguishing engines, only they are double; that is, one within another. The inside one, which conveys the air, is about $1\frac{1}{2}$ inches

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[*] It is but recently that a chain has been used. Some months ago, the chain was substituted for a thick cable. An accident, though fortunately unattended with any evil consequences, except a great deal of alarm to the divers, led to this change. During the night, a heavy fall of rain had so swollen the rope, that on the morning, when they were lowering the bell with the divers in it, after the rope had run through the block so far as to allow the bell to descend several feet under water, it stuck, and could neither be made to go one way or the other, nor could the power of the machinery move it. The bell thus hung, to the extreme alarm of its inmates, who were, of course, utterly unconscious of what had happened, until a new tackle was rigged, and they were extricated from their perilous situation. This suggested the present mode of using a chain tackle. We believe it was suggested by one of the Commissioners, but does not altogether meet with the approbation of Mr. Foote, who thinks a rope would give some warning before it gave way, which a chain cannot do.—*Eds. Glas. Mech. Mag.*

[†] The ebullitions on the surface have an extremely beautiful effect; and, for a considerable distance around the bell, present an appearance at once astonishing and interesting.—*Eds. Glas. Mech. Mag.*

diameter; and the outside one, which is merely a protector, 3 inches diameter. From the inside of the roof, are suspended two strong chains, by application of which, with the power of the crane, the divers carry, with the greatest ease, stones weighing 7 to 8 tons each. The stones are made to their proper sizes on shore, and promiscuously tumbled overboard, when the aquatic masons fix them in their proper beds. From the ease with which the stones can be moved under water, two men can build from 500 to 1000 feet per day. No mortar of any kind is used, as the stones remain sufficiently firm with their own gravity; and when the ponderous stones above are added, they are bound together like a rock.

It is because of the bell being filled with the atmospheric air that the water does not rush in at the open bottom; as it descends, the increased weight of water above proportionally compresses the air, and consequently raises itself within the bell. When at the depth of 18 feet, and although the force pump was in slow operation, I noticed that the water had risen in the bell about 4 inches:* to displace this, the signal for more air was given; and in a few seconds the water disappeared. To represent this, let us take a tumbler filled with water, and an empty wine glass; let us put this wine glass into the water, mouth downwards: it will be observed, that though the glass is immersed in the water, there is little or none within it; it will also be seen, that as we sink it the air becomes compressed, and the water rises within. If we now forced air into the wine glass, the water that has risen within it could be easily displaced and a fresh current maintained, as long as the operation is continued—exactly in the same way is fresh air supplied to the diving-bell: so effectually is the water expelled, that I stood within it on a stone at the bottom of the sea, and though I wore at the time slight summer shoes, I felt no dampness; though at first, I must confess, I felt a little alarmed, particularly when entering on the surface of the water.

At Port-Patrick, there is the greatest difficulty in getting a proper foundation, which but for the skill of the diving art would have been impossible. The bottom of the sea is covered with weed as thickly studded as any plantation or brushwood on the surface of the ground. The trunks are very stout, and have to be felled with axes; then comes rock, the points of which jut upwards from 6 to 8 feet. This rock is of hard whin; can be removed only by blasting; and is very difficult to bore. The builders at this time become quarrymen; they send home their jumpers in the best way they can; into the aperture thus made, a tin cannister, measuring 12 inches by 2 inches, filled with gunpowder, is inserted; to this cannister are screwed tubes, half an inch diameter, end to end, until they reach the surface. These screwed joints are numerous, as short lengths only can be applied, from the little room there is to work within the bell: the bell is then removed to a distance, and from the top of this tube, a piece of heated iron is dropped down; off goes the blast, with noise like thunder, and the tube flies like an arrow, until stopped by a cord previously attached to it, and brought back for further use. The divers make their signals, so as to communicate their wishes or orders to the region above, simply by striking the side of the bell with a hammer. The number of strokes indicate the command: for instance, 1, is more air; 2, hold on or stop the crane; 3, heave up; 4, lower down; 5, east; 6, west; 7, south; 8, north; 9, down box for stuff, or for written communication; 10, want materials down. Although the sound of the bell is heard at a great distance, yet there is a man appointed for the special purpose of attending to the signals, and giving orders to the workmen on deck. I was told that when the bell is laid aside for some days, on its being again used the sound is much more distinctly heard. This must arise from the moisture previously absorbed being dried up, and should show the absurdity of hanging church bells in situations where they are exposed to every storm. In a clear day, so soon as the bell dips its ponderous edge into the water, the bottom of the sea is distinctly seen; and it is amusing to see the fishes of all sizes and kinds skipping and dancing in every direction. Some of them seem to be alarmed at the divers, and disappear as soon as they approach; others become quite familiar, and continue skipping around them. Some are known as favourite fishes, and are marked as regular visitors; one in particular, considered a *pet fish*, is known to the divers as an hourly visitor. From a humorous article in the Dumfries Magazine, I learn that this fish is of the *Lythe tribe*. Sometimes the divers are visited by monsters of the deep. A congar eel, upwards of 6 feet long, once made its appearance; it was wounded with the jumper, and disappeared; but in a few minutes returned unobserved to the workmen, and was in the act of raising its head with extended jaws to embrace the workman's arm, when it was immediately despatched. The divers told me when we were down, that they knew the approach of wet weather from the great quantity of water that dropped upon them from the top and sides of the bell: this is occasioned from the moisture with which the air is charged, and forced down by the pump; then attaching itself to the inside surface of the bell, forming globular drops, and copiously pouring itself upon the inmates. I was told also by the divers, that when at the bottom of the sea they knew the approach of a hurricane much sooner than the workmen in the hulk, or any one on shore. When they see the fishes get into confusion, or when they observe the sea weed or tangle shaking at the bottom, it is time to give the signal for ascent; but sometimes the hurricane comes on so rapidly, that it would be certain destruction both to the bell and its inmates, if brought to the surface. In these cases the hulk is dragged on shore, with the bell and the divers under water, to a sheltered place, where the prisoners are released from their cell. As to the health of the divers, it must be obvious that the pressure of air forced into the bell must affect the lungs of the inmates, notwithstanding, to use their own words, "those who agree with it thrive wonderfully." Mr. Foote and his assistant bore evidence of this, for both were as like their meat as their work;*

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* Among the first of *our* numerous descents, the water rose above a foot in the bell; but a promptly answered signal at once expelled the water, and dispelled our fears.—*Eds. Glas. Mech. Mag.*

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* We are happy to understand so; for we have occasion to know that Mr. Foote at one time complained of much pain of chest, and entertained considerable apprehensions for the state of his lungs, but which, from the use of the Stethescope, his medical adviser assured him was not the case. He has obtained, we understand, great benefit from wearing a hare skin next his chest.—*Eds. Glas. Mech. Mag.*

but they told me of an Ayrshire man who twice attempted the work, but on his second attempt his lungs were so much affected as to cause his death. Strangers descending uniformly feel, as I did, a great pressure on the openings of the ear; but with some the consequences are more serious—bleeding at the mouth and nose, convulsive fits, &c.

The diving-bell, in its present improved state, can be used with as little risk as attends building and mining on shore; and is calculated to effect the most stupendous results, which, without it, could never be attempted: for instance, at Port-Patrick, no useful or substantial pier could ever have been erected without the diving-bell; and although the work is not half completed, already its effects are seen and acknowledged. With the force of steam navigation, and having such a safe and commodious harbour, the arrival of the Irish mails can now be calculated upon with nearly the same certainty as the arrival of the mail coach; and an easy and a regular intercourse betwixt Ireland and its sister kingdoms is thus established.

The diving-bell has been long used in collecting the wrecks of ships at sea, but might be applied with advantage to many useful purposes besides this and the building of piers and bridges. For instance, it might be used by Humane Societies in searching for unfortunate sufferers by water; and it would be a most useful appendage to every dredging machine. With it the river or harbour deepener could traverse the scene of his operations, and ascertain the nature of the soil he has to work upon under water, as easily as the mender of high roads can examine the field of his labour above ground. He would then be able to give orders correctly as to the application of the buckets, and the movement of the vessel, which, I think, would save a great deal of power, lost at present by every dredging machine, entirely on account of the workmen's ignorance of the state and soil of the river at which they work. A bell in this situation would be required only for observation; it might be half the size of the one I have described, and could be erected and wrought at half the expense, especially in dredging machines that have steam power.

Description of the Plate.

Fig. 1, the hulk with the crane; the air-pump and diving-bell near the surface of the water.

Fig. 2, the diving-bell, and workmen in the act of building; one of the workmen, with the hammer, giving a signal. A, the mason work finished; B, cliffs of rocks; C, stones laid down; D, D, D, air bubbles ascending to surface.

Lines composed at the Bottom of St. George's Channel, in the Port-Patrick Diving-Bell, Thirty Feet below the Surface of the Water,—Sept. 1823.

What joy so sweet, or so sincere,
As pleasing those our hearts hold dear?
And who dearer to my heart than thee?
No! there is none, or ever now can be.
Who with thy fond maternal cares
Have watch'd my progress through my tender years;
Whose smiles gave zest to every joy;
Who did my opening thoughts in useful lore employ;
Who, with thy mind well stored,
With me the historic page explored;
And strongly on my soul impressed,
That he who virtuous lives, lives best;

To thee I dedicate my humble lay,
Where in the sportive dance the Tritons play;
Each to resounding conch call forth their queen,
And join in festive mirth with Naiads green.
Oft ocean has the poet sung,
How on thy bosom borne
The towering bark, her daring crew,
Regardless of the lashing storm,
Wafts on her pathless way,
From Lapland's darkness to meridian day:
Nor to the aeronaut thy lays dost thou refuse
To paint his boldness, ever generous muse;
As in course majestic he ascends,
Aided by Art's all powerful stores,
The ocean ether round our world extends,
And laves of other orbs the distant shores.
Then may I crave thy smile benign
On this first lay, beneath the brine,
To paint its wonders, and the powers which Art
To daring man with liberal hand impart!
Cased in thy iron walls, thou far-famed bell,
My faith in thee, O Art, all fears dispel;
I with undaunted heart the scene survey—
Behold the finny brood in gambols play!
Or with terrific course our vast machine,
Fly far into their world of waters green;
Here the stern rocks in caves and chasms yawn,
Where light's sportive rays scarce ever dawn,
So closely shade the tangling weeds,
Within whose verge the astonished cancer breeds.

Medicus.

ON THE DISEASES INCIDENT TO MECHANICS.

By a Physician.

[A LARGE proportion of the community are obliged to devote themselves to trades or occupations, in the exercise of which, they are exposed to innumerable noxious matters in the gaseous, liquid, or solid forms. Many are exposed, in the prosecution of the mechanical arts, to inclement weather, and alternations of temperature, circumstances highly injurious to health, and unfavourable to longevity. The total removal of these dangers and inconveniences to which their different occupations expose the workmen, could only be effected by giving up the art or calling they exercise. The abandonment, however, of many of these trades, would, in the present state of society, have the effect of compromising the interests of the community, and, in short, cannot be relinquished without ruin to individuals—the extremest injury to the public in general. Under such circumstances, the application of professional skill derives a peculiar lustre, for never does science assume so beautiful and lovely an aspect, as when its practice or its precepts are imployed in contributing to the comfort and well-being of mankind, or in the illustration of the evils inseparable from our state.

We deem it, therefore, a duty which will not be unacceptable to many of our readers, to occasionally afford a short space for the insertion of the remarks of a professional friend who makes, and has, during the course of his studies, made the diseases of artizans the subject of his observation.]

No. I.—On the Diseases to which Bakers are exposed.

This class of artizans or tradesmen are both numerous and important, from their utility to society, and, therefore, deserve our notice. In the early periods of all nations, every man seems to have performed for himself those offices which an increasing demand, and the division of labour, necessary in more refined ages, renders him dependent on others for. Thus each man in rude and early times was his own tailor, his own shoemaker; and the baking of his bread was classed amongst the processes of domestic economy, which, as well as others, were performed by persons entirely set apart to the performance of domestic duties. But when, either from the superiority of the article furnished by those who exclusively directed their labours to one process, or the labour and time of individuals being exclusively requisite to some other art, men gradually set themselves to the exercise of this as well as other trades. Amongst the Romans, a long period elapsed before any betook themselves exclusively to baking; for it was not till five centuries after the foundation of the city, that, as Pliny states, bakers began (exclusively) to practise their trade; previous to which time, it was a branch of the culinary art practised by the female domestics of each family. But on the overgrown state of the population of the city, it became a business in which, however, (as was the case in almost all the trades of that warlike people,) slaves were principally, if not exclusively occupied; and if we attach any degree of credit to the anecdote so often related of the good king Alfred, we must believe that the making of bread in our own country was also a part of domestic economy in the early ages of our history.

In the present day, this class of artizans are extremely numerous, each little town having an extensive bakery for the supply of its inhabitants, and those of the vicinity. The younger workmen of this trade soon loss the bloom of health—the characteristic of early life; and I think the majority of them become thin, and that they do not, in general, possess the most vigorous constitutions.* They are, however, by no means devoid of muscular strength, a circumstance they owe to the active use of their arms, in different departments of their occupation. The paleness of their visage I refer to the heat they are continually exposed to, not more remarkable in them than in the blacksmith, glass-blower, fire-men attendant on steam engines, and others whose faces are exposed to a strong heat. On the Continent, bakers are addicted to indulgence in spirits, and that more especially at the early hours which their labours require of them: hence they are the frequent subjects of severe irritations of the stomach, and of eruptive diseases; and though I wish not to be understood to lay the charge of this excess to the bakers of this country above other tradesmen, still they cannot altogether be exculpated from this baneful indulgence, and from which they would do well to refrain.

Though I cannot say I have observed so many cases of consumption amongst this class of workmen myself, as I *a priori* should have expected, I am informed from various authentic sources that they are often its victims. This has been referred to the powder, or flour, floating in the atmosphere, and which being inhaled, irritates the lungs, and produces the state of disorganization of that organ on which consumption depends. Now, though I am somewhat sceptical as to this explanation, it must, from the influence of opinion, have its weight; yet I should rather attribute it to these alternations of temperature they are exposed to,—to the irregular hours their business requires—to their indulging in repeated draughts of cold water, when warm and perspiring, to which the thirst excited by the heat they are exposed to urges them; and I know no class more careless of those comforts and benefits to health, arising from proper clothing, of itself a fruitful source of pulmonary complaint. Their eyelids and eyes are, however, from the irritating presence of the flowery dust caught by the eyelids, and forming there a paste or crust, frequently subject to a degree of inflammation, to which the circumstances narrated above, and especially their frequent night-work may also materially contribute. Diseases of the heart have also been mentioned by some Continental writers as frequent among them; but I have, within the last week, seen more than fifty bakers, none of whom have ever had such affection themselves, nor do they ever recollect any being so afflicted. The cause, however, to which these affections are attributed, is the severity of their labour in kneading the dough; but I certainly do not consider severe labour as in any degree peculiar to this class of workmen. A varicose state of the veins of their lower extremities, I have repeatedly seen—a circumstance we should naturally expect from the erect position their legs maintain, and the pretty vigorous and constant action of them necessary to one part of the process they conduct. The ulcers frequently accompanying this state of the veins of the lower extremities, are by no means uncommon in bakers, especially on the Continent. Their frequent exposures to alternations of heat and cold, carelessness of proper and comfortable clothing, their indulgence in draughts of cold fluid when warm, to which I have already alluded, render them subject to cold in the head, rheumatism, and, what is worse, inflammation of the chest. There is a cutaneous eruption, which, though they be not exclusively subject to it, is so frequent in them as to have obtained the appellation of "Bakers' Itch." This arises from the irritation of the flour and other matters employed in the process, and is common to bakers, with masons, plasterers, and other tradesmen whose hands are exposed to the inhaling substances used in their respective trades.

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* Stell remarked the liability of workmen in this trade to sink under the attacks of malignant fevers; and in the plague of Marseilles, in 1720, Palessier mentions a most remarkable mortality in this class, so much so, that they were obliged to send to the neighbouring towns for a supply of the indispensable product of their labours.

We shall resume this subject next week, with a short detail of those means by which these exposures inseparable from this trade may be modified or alleviated, so as to prevent any injurious consequences, and to point out those remedial means by which art affords her succours to those labouring under the affections already enumerated.

DESCRIPTION OF EDINGTONITE, A NEW MINERAL SPECIES.

By William Haidinger, Esq. F. R. S. E.

With an Analysis by Edward Turner, M. D., F. R. S. E., &c., Lecturer on Chemistry, and Fellow of the Royal College of Physicians, Edinburgh.

[From the Edinburgh Journal of Science.]

Among a great number of interesting minerals from the neighbourhood of Glasgow and Dumbarton, in the possession of Mr. Edington of Glasgow, with the inspection of which I have been lately gratified, I observed some crystals disposed in the cavities of Thomsonite, which at first I expected would belong to that species, but I soon found that their faces could not be identified with those mentioned in the descriptions of it, as given by Messrs. Brooke and

Philips. Mr. Edington had the kindness of entrusting me with the only specimen of the substance which I could discover in his collection. It is in compliment to that gentleman that the name of Edingtonite is here proposed for designating the species.

The regular forms of Edingtonite, even if we do not attend to the interest attached to every novelty, are highly deserving of notice on account of their forming the only second instance, among natural crystals, of hemi-pyramidal forms with inclined faces; the first example observed being the species of pyramidal copper-pyrites. Hemi-pyramidal forms are in general very rare; the pyramidal scheelium-baryte of Mohs, (tungstate of lime,) is the only well authenticated instance of such as have parallel faces. Perhaps pyramidal felspar also belongs to this class. This kind of distribution of faces is, however, quite different from that in the Edingtonite, from which it likewise considerably differs in its angles, though the specific gravity of the two substances, and their cleavage, are nearly the same.

Edingtonite occurs in crystals, the largest about two lines in diameter, implanted upon crystallized Thomsonite, in the Kilpatrick hills, near Glasgow. It is accompanied by calcareous spar, and a curious variety of harmotome, (the paratomous Kouphone spar of Mohs,) in twin crystals. In these, the faces of the four-sided pyramids, visible in most other crystals, have entirely disappeared, and the re-entering angles at the summit are produced solely by the faces of a horizontal prism. It may be considered in this respect as the last term of a series of varieties, some of whose members were first described by Professor Weiss. The crystals of the Edingtonite itself are far from possessing such a degree of perfection, that the angles given above could be regarded as anything more than approximations, although their general form is well defined. They resemble greatly certain varieties of prehnite and felspar, but we must wait for the discovery of other varieties of it, which may afford a more extensive knowledge of the species, to enable us to determine the genus in the Order Spar of the system of Mohs, to which it might be referred.

Analysis of Edingtonite.

It yields water when exposed to heat, and becomes at the same time opaque and white. Before the blow-pipe it fuses into a colourless glass, though a pretty strong heat is necessary for that purpose.

Muriatic acid acts upon it, separating silica in a gelatinous state; but the action did not appear sufficiently perfect for the purpose of analysis.

2.365 grains of the mineral (the whole quantity in my possession) were heated to redness, and lost 0.315 of a grain, or 13.319 per cent. of water of crystallization.

The residual 2.05 grains, which crumbled easily into powder, were mixed with six grains of carbonate of soda, and kept at a red heat during half an hour. The ignited mass was quite white, and had not fused. Dilute muriatic acid dissolved the whole of it, except a few flocculi of silica. The solution was brought to dryness, and the silica, after being collected on a filter and heated to redness, weighed 0.89 of a grain, which is 35.09 per cent.

The solution thus freed from silica, was treated with a slight excess of carbonate of soda at a boiling temperature, when a white precipitate subsided. It was digested in pure potash, to dissolve any alumina that might be present, and the alkaline solution, when boiled with an excess of muriate of ammonia, yielded a portion of alumina, which, after exposure to a white heat, weighed 0.655 of a grain, being 27.69 per cent.

The matter which did not dissolve in potash, proved to be an earthy carbonate; for it dissolved with effervescence in muriatic acid. On neutralizing the solution exactly, and adding oxalate of ammonia, a white precipitate subsided, which yielded 0.3 of a grain, 12.68 per cent. of pure lime.

To the solution, after the separation of lime, carbonate of ammonia and phosphate of soda were added. No precipitate formed, and hence no magnesia was present. Iron and manganese were likewise absent.

The Edingtonite hence contains,

Silica,	35.09
Alumina,	27.69
Lime,	12.68
Water,	13.32
	88.78

As the various substances found to exist in this mineral do not account for the quantity submitted to analysis, it doubtless contains about 10 or 11 per cent. of some alkali, the nature of which I have not been able to ascertain.

SECOND REPORT OF THE HADDINGTON SCHOOL OF ARTS.

The Committee of the Haddington School of Arts, have great satisfaction in submitting the following Report of the state and progress of their Institution during the past year.

After the close of the lectures on chemistry last session, the students somewhat initiated in the properties of *matter*, felt desirous (such is the stimulus which knowledge imparts) to become acquainted with the science of *mind*. Accordingly, instructions were delivered twice a-week, for the space of three months, on *Man*, considered as a sentient, as an intellectual, and as a moral being, by this arrangement embracing the principal topics in the philosophy of mind and of morals.

These lectures were well attended, were listened to with much interest, and, it is hoped, not without profit.

On the 2nd of November last, Dr. Lorimer resumed his lectures on chemistry, and its application to the arts. This course being more full and extended than his former one, two lectures a week have been delivered for seven months past. The attendance has been good, and, when the intricacies of the subject are considered, the proficiency of many of the students great. This, with respect to some, was easily ascertained, as Dr. Lorimer regularly, before commencing a new lecture, examined such of his pupils as were inclined, on the subject of the preceding—an exercise calculated to be very useful, by not only affording an opportunity to the public of judging of the growing acquirements of the students, but also by forming them to general habits of attention, at the same time correcting their mistakes and enlarging their conceptions by new and familiar illustrations.

The Committee are persuaded, that every individual who heard, either regularly or occasionally, the very able and interesting lectures of Dr. Lorimer, and witnessed the experiments by which they were illustrated, must be deeply sensible of the obligations under which that gentleman has laid the Institution; nor have they any doubt but that in the ensuing session, many, from all classes of the community, will avail themselves of an opportunity of prosecuting branches of education, the advantages of which were never before enjoyed in Haddington.

To Mr. Hardie, of the mathematical academy, the School of Arts feel particularly obliged, by the frank and liberal manner in which he undertook to give instructions to the students in geometry and practical mathematics, preparatory to their commencing the study of natural philosophy; and though all have not a relish for such abstract studies, some, the Committee are glad to know, are prosecuting them with zeal and success.

When the labour and time gratuitously devoted by Dr. Lorimer and Mr. Hardie to the instruction of the students, is considered, the public will be better able to appreciate the value of their services to the Institution.

The library this year has received a considerable accession, from part of the funds being applied to the purchase of scientific books, and from the donations of benevolent individuals. It now consists of 91 volumes. Of these, since May 1824, there has been nearly 380 issues, which among 60 readers, amounts, on an average, to between 6 and 7 volumes to each reader annually, as high a proportion of reading, it is believed, as obtains in ordinary libraries. Indeed, when the nature of the subjects treated of is compared with the circumstances of the readers, the difficulties to be overcome, and the inadequacy of the time and aids provided for that purpose, the result is exceedingly satisfactory.

It is intended, next session, to give instructions on the principal branches of Natural Philosophy: comprehending Dynamics, Mechanics, Hydrostatics, Hydraulics, Pneumatics, Acoustics, Magnetism, and Electricity; which, it is obvious, will form a most important and useful addition to the course. But the nature and extent of these instructions will depend on the ability of the Committee to procure a suitable apparatus.

The particular subscriptions and donations will appear in the Appendix, and the subjoined note will put the public in possession of the amount of the funds, and mode of expenditure.

Amount of Subscriptions and Donations,				£64	2	6
Balance due the Treasurer,	£2	6	1½			
Apparatus and Chemical Reagents,	25	6	1			
Paid on account of additional Apparatus,	18	0	0			
Books and Binding,	14	10	9			
Incidents,	3	12	4			
				63	15	3½
				£0	7	2½

Your Committee cannot allow the present opportunity to pass, without acknowledging the liberality of the magistrates and council of the burgh, in granting them an additional donation of £5 : 5, and accommodating the Institution with the use of their school-room. They have also gratefully to acknowledge the present of an excellent air-pump, from Mr. John Howden, Ugstone; and, also, the friendly support of several ladies and gentlemen. They would particularly mention the kindness of Mr. Horner, the able secretary of the Edinburgh School of Arts, in transmitting various publications connected with such institutions, and for his general attention to the interests of their society.

The Committee are aware of the delicacy of their situation, in again soliciting the pecuniary aid of the public, in an age when continual applications are made for it, in behalf of objects which, it were prejudice not to allow, are more noble. But if it admits of no doubt that their Institution directly tends to improve the character and circumstances of the most numerous class in the community, and through it, of the nation at large, it cannot be unreasonable to renew a request which has already been favourably received. In doing so, they frankly acknowledge, that they cannot plead any great visible success as the foundation of their claim. Nor would they be acting honestly towards a benevolent public did they hold out the expectation, that the influence of Schools of Art upon the amelioration of society, would be either very rapid or conspicuous. On the contrary, it is their belief, that it must work slowly and silently. This is not, however, a consideration which should produce indifference. The very circumstance that neither a strong feeling is addressed, nor a fine prospect speedily realized by a given project, so far from abridging, should enlarge the public liberality in its favour, inasmuch as otherwise it is in danger of receiving a patronage greatly disproportioned to its value and importance.

From what has been already observed, it is obvious, that the sources of expense are numerous. Apparatus and materials for performing experiments, are as essential to the accomplishment of the objects contemplated, as a scientific library; and it cannot be expected, that these should yet have reached the price most suited to the purses of mechanics. In such circumstances the generosity of the public is their only resource.

Were it necessary to justify their appeal, the Committee might urge the approaching independence of their Institution as a reason for present aid. Schools of Art are not intended to be perpetual orphans on the public favour. On the contrary, every shilling which they now receive is adding to their permanency, and accelerating the days of their manhood. Like our parochial schools, they need something equivalent to an endowment at first, to render the fees derived from the students moderate; but books and apparatus once provided, it is calculated, the remaining expense will fall within their own capabilities.

From the tendency of such institutions

to unite the higher and lower orders of society, a very pleasing argument in their favour might be formed. The many evils of a separation here, need not be enumerated. Not only like a disjunction of the provinces from the capital, does it generate and cherish local prejudices, but in the minds of both parties creates distrust and suspicions very hostile to improvement. There is no way of removing these but by multiplying the facilities of intercourse, and so rendering men of all ranks well acquainted with each other. But how can this be done more effectually than by increasing the materials of thought and conversation held in common? It is not so much owing to any natural aversion that the different orders in society have hitherto receded to such a distance from each other, as to the impossibility of maintaining an intercourse after it is once begun, from the scantiness of topics of common interest. Science, however, by creating these, will accomplish for the various ranks in society what steam is doing for the towns and cities of our empire, and will blend into harmony the exertions of men, who in the hour of danger might otherwise, by their mutual jealousies and dissensions, have proved the worst enemies of their country's safety.

To these considerations, others of equal force might be advantageously adduced, did the limits of this Report allow. It were easy to show, for instance, that the education of the higher orders will receive an impulse from the lower; that the preparations of the student, aspiring to be the conductor of a mechanics' seminary, will quicken the remissness of many of his fellows in the university; and that mechanics themselves, by their important discoveries in the arts, the first fruits of which have already appeared as the pledge of that higher success which awaits their improved instruction, will greatly promote the national wealth and prosperity. It might be shown also, that both morality and patriotism are linked with the same cause. That by elevating the popular mind, a higher tone of independence will be communicated to lower society, qualifying its members better to bear reverses of fortune, while a manliness of mind will be created, too noble to stoop to the degradations of pauperism.

REVIEW OF DR. THOMSON ON THE ATOMIC THEORY.*

[From tbe London Journal of Science.]

THE well-known author of this work regards the soul and body of chemistry to consist in a knowledge of the relative weights of the combining substances. This is to form a very narrow conception of the science. The truc function of the chemical teacher is announced in the following verse of the Roman poet:

> In nova fert animus mutatas dicere formas
> Corpora.

It is the characteristic of chemical genius to reveal new elementary bodies, to form new compounds of the elements known before, to discover new qualities and relations both among simple and complex substances, and to arrange the manifold and marvellous phenomena of corpuscular action, under a few general laws. The philosopher of ardent and inventive mind, content to know the general proportions, is unwilling to stop his career of discovery in order to learn the minute fractional quantities; nor will he suffer his whole faculties to flutter round the oscillations of a balance. Let none, however, hence imagine, that we desire to disparage quantitative research; we would only assign it a place of due subordination below the qualitative, conversant with new powers and forms of matter. To view with Dr. Thomson, the first principles of chemistry as consisting in an enumeration of weights and measures, is to narrow and debase the science into an affair of addition and substraction. This arithmetical process is, no doubt, a valuable accessary; but can never compete either in interest or utility with the knowledge of the chemical affinities, from whose play, the countless diversities of composition and unceasing successions of form in the material system are derived. These are the grand principles of chemical action, an acquaintance with which must necessarily take precedence of the study of quantity.

It is deeply to be lamented that the latter kind of inquiry, which, as exhibited in the work before us, can hardly be deemed an intellectual operation, should have usurped, to too great a degree, in some recent publications, the place of researches into the *powers* that modify matter. Admirable specimens of this sublime study are to be found in the statics of M. Berthollet, the Bakerian Lectures and "Elements" of Sir H. Davy, and in many memoirs of M. Guy Lussac and Dr. Wollaston; and the individual, who should collect and arrange these into a compendium volume, would do no mean service to science. Of such philosophical principles we can perceive no trace in Dr. Thomson's book; though the modern multiplication of chemical objects, simple and compound, loudly demands their general connexions and dependencies to be developed.

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* An Attempt to establish the First Principles of Chemistry. By Thomas Thomson, M. D., Regius Professor of Chemistry in the University of Glasgow, F. R. S. Lond. & Ed., &c. &c. Loudon, 1825.

"An attempt to establish the First Principles of Chemistry by Experiment," is the title of Dr. Thomson's book; a title that may be understood in two senses. First, it may seem to imply that the Doctor modestly offers his labours as a mere attempt; or secondly, that others before him might perchance have laid down first principles of chemistry, but that the grand era of *establishing them by experiment*, was reserved for himself. The reader is not left long in suspense by the ambiguity of the title; for the first pages show that the latter conceit has taken possession of the author's mind. From the preface, indeed, one might be led to look for some of those Herculean achievements with which Sir H. Davy astonished the world in his Elements of Chemistry, although his title-page did not blazon them forth. But *nulla fides fronti* is an adage which the reviewer has too many reasons to recollect.

We shall not, however, deal ungenerously with the Doctor; far less mete out to him with his own measure. We are ready to admit, that, by noting the mutually precipitating quantities of two neutral salts, he has, in several cases, given useful corrections of the primitive combining weights of bodies; and that he has, on some occasions, shown errors in the second, and even first, decimal places of numbers formerly found. But, undoubtedly, his chief ingenuity is displayed in concealing, throughout the details of the book, the previous researches on the same topics of other experimenters, even when their results do not perceptibly differ from his own, which he presents as absolute perfection. Hence a young student will be led by the perusal of Dr. Thomson's "Attempt," to consider it both as the commencement and completion of chemistry, since he deigns to notice few precursors, and those chiefly for the purpose of pointing out their mistakes. He *demonstrates* his own numbers to be true, frequently to a millionth part; and rarely rests satisfied with a possible error of one part in a thousand!

Nothing places in so strong a light the vast improvement of practical chemistry during the last thirty-five years, as a comparison of modern results on chemical equivalents, with those obtained by Richter in his Researches published in 1792, and some succeeding years. He mixed together two neutro-saline solutions, in such a proportion, as to produce their mutual decomposition, as indicated by the complete precipitation of the new-created compound. This chemical operation is very simple, and with regard to many substances, susceptible of very considerable precision. Yet Richter's equivalent numbers are so erroneous, as to show that he must either have been very careless, or have employed very impure salts. Wenzel, a much earlier writer, and the real author of those general views which Richter prosecuted concerning mixed saline solutions retaining the state of neutrality or acidity which they previously possessed, had however made far more accurate researches on the composition of salts; but these have been unaccountably neglected, though capable of furnishing excellent data for the theory of chemical equivalents.

Fischer, in the compendious table which he constructed from Richter's voluminous experimental tables, states sulphuric acid at 1000. Hence if we divide his equivalent numbers by 20, the quotients will show their relation to sulphuric acid reckoned 50, as it is on Dr. Wollaston's scale. The following are a few of those quotients:

Potash	80
Soda	43
Ammonia	33.6
Nitric acid	70
Lime	39.6
Magnesia	30.7
Barytes	111.1
Muriatic acid	35.6
Carbonic acid	28.8

Surely nothing but the impurities of the bodies submitted to experiment, can account for the errors in these numbers; the three acids presenting the only tolerable approximations to truth. And indeed till chemicals could be procured in a state of purity, the method of research, by ascertaining the mutually precipitating quantities of saline matter, was quite nugatory. At the present day, however, the greater part of the most interesting saline compounds are prepared for sale by the manufacturer, so beautifully crystallized as to be quite free from impurities, and admirably adapted for the investigation of equivalent numbers. Such articles, made on the great scale by eminent dealers, are generally to be preferred for scientific purposes to those made in little capsules by the closet experimenter.

When the happy idea of atomic combination was broached by Mr. Dalton, chemical synthesis and analysis had become much more exact, as his collation of results exhibits. In the first volume of his "New System," published in 1808, we find the following numbers, reduced to oxygen 10, and sulphuric acid 50.

Azote	7.1
Carbon	7.1
Phosphorous	13.0
Sulphur	18.6
Barytes	97.1
Magnesia	28.6
Lime	33.0
Soda	40
Potash	60
Nitric acid	27.1

The only articles here very erroneously given are azote and its compound, nitric acid. Most of the other numbers do not differ much from the latest determinations; while those for soda and potash are exact.

Berzelius, familiar at an early period with Richter's speculations, was naturally prepared to embrace Mr. Dalton's views of atomic combination. He zealously set to work to determine, by the most refined and rigid methods of analysis and synthesis, the true proportions in which chemical bodies combine. His successful labours formed the groundwork of Dr. Wollaston's valuable memoir on chemical equivalents. It is meanwhile worthy of remark, that Berzelius should very rarely have had recourse to Richter's method of mutual precipitations in order to infer the atomic number of an unascertained salt, or of its constituents, from that of one already known.

Dr. Thomson is the first chemist who has methodically pursued this very simple and obvious route. Operating with the purer salts of modern times, he has been enabled to rectify and define the atomic numbers of a good many compounds; and thence also to deduce, on some occasions, the atomic weights of their constituents. He commenced this task in the "Annals of Philosophy, for Nov. 1820," in which he published the atomic weights of barytes, potash, soda, muriatic acid, protoxide of lead, sulphuric, nitric, and chromic acids. Of the numbers for the first four, as stated by Dr. Wollaston, he corrected the second decimal figure; the others seem to have admitted of scarcely any alteration, for Dr. Thomson's numbers nearly coincided with the previous determinations of Wollaston and Berzelius.

(To be continued.)

REMARKS ON THE PROGRESS OF STEAM NAVIGATION.

By William Bain, Master in the Royal Navy, and Commander of the City of Edinburgh Steam-Packet.

Although the art of navigating vessels by steam may still be considered in its infancy, yet no invention we know of has, in so short a time, made greater progress towards perfection. It is no doubt true, that nearly a century has elapsed since Mr. Jonathan Hulls, an ingenious mechanic of England, under letters patent, first made the attempt of applying steam to the purposes of navigation. The late Duke of Bridgewater, and Earl Stanhope, and others, were occupied with this subject; and we have also to record the labours of Lord Dundas and Mr. Miller of Dalswinton, assisted by Mr. Symmington, engineer, all of whom displayed much public spirit and talent in the accomplishment of the same great object, without their having, however, arrived at the result sought after, viz.

the application of steam to the general use of navigation. This, in so far at least as regards this country, was reserved for Mr. Henry Bell of Helensburgh, in Dumbartonshire, who, in the year 1811, practically succeeded in constructing and propelling a vessel by the application of steam. It is believed that this gentleman, so far back as the year 1799, produced the model of an engine for this purpose, which, though it was not approven of by the persons to whose inspection it was submitted, instead of weakening, served only to strengthen Mr. Bell's enthusiasm. Possessed of an active mind, he is said to have crossed the Atlantic to America, where this system was readily adopted, insomuch, that by the year 1821 that country could boast of not fewer than 300 steam-vessels in full operation, while others to the extent of 5995 tons were also then building. No longer uncertain of the result of his scheme, Mr. Bell, like a dutiful son, returned to his native country with the fruits of his well-earned adventure; and, in 1811, constructed the Comet steam-boat of twenty-five tons register, with an engine of only four horses' power, to navigate the Clyde between Helensburgh, Greenock, and Glasgow. Alas! while every one through his means understands the construction and management of the steam-vessel, and exults in this mighty invention, its great promoter, unrewarded, is fast sinking into years, and is borne down with poverty.

The spirit of enterprise soon beheld the impulse which this astonishing power was capable of affording to the capitalist, and though opposed by every circumstance which ignorance, prejudice, or interested motives could suggest, Great Britain can now boast of not fewer than one hundred and fifty steam-vessels, of from thirty to five hundred tons register, propelled by engines, varying in power from four to one hundred and forty horses; or, by another view, it may be stated that 16,000 tons of shipping are borne forward by engines of the aggregate power of 5000 horses, the first cost of which cannot be estimated at a less sum than half a million sterling. Of this number, twenty are employed on the Thames, in the annual conveyance of at least 100,000 passengers to Margate, Ramsgate, Southend, Gravesend, Calais, Rotterdam, Scarboro', Leith, &c. In estimating the vast importance of these vessels to the community, if we allow each individual on board to spend only thirty shillings for passage money and entertainment, the sum of £150,000 must in this way be annually expended from the port of London alone. Seventeen steam-packets, in the same manner, sail from the Mersey; twenty-nine from the Clyde; ten from the Forth; fifteen from the Tyne; four cross the Irish Sea, with the mail, from Holyhead to Dublin; two between Milford and Waterford; two between Bristol and Bath; four from Belfast; four upon the Tay; ten upon different canals; and, lastly, one plies on Loch Ness, commanded by our unfortunate hero, Mr. Bell, who has been driven from station to station, and seems doomed here to end his days in earning a scanty and precarious subsistence.

(*To be continued.*)

MISCELLANIES.

New species of Cotton.—A specimen of a peculiar kind of cotton, the growth of Columbia, has been recently exhibited at Havannah. It was obtained near Bogota, and is said to be of an extremely soft and perfectly silky texture, and glossy appearance, of a short staple and dingy colour. It grows on a tree of considerable height, different from our plant. The cotton grows round the seed, in something like the shape of a pine apple, so that when picked it requires no spinning. The Indians work it into shawls, &c.; and a quantity has been sent to France for the purpose of ascertaining whether it cannot be incorporated into the manufacture of silk goods.—*Demerara Gazette.*

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MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

> "The moon,
> In dim eclipse, disastrous twilight sheds
> O'er half the nations, and, with fear of change,
> Perplexes monarchs!"

No. C. *Saturday*, 19*th November*, 1825. Price 3*d*.

A PROJECTION OF THE LUNAR ECLIPSE TO TAKE PLACE ON THE 25th NOVEMBER, 1825; MODE OF HANGING VENETIAN BLINDS.

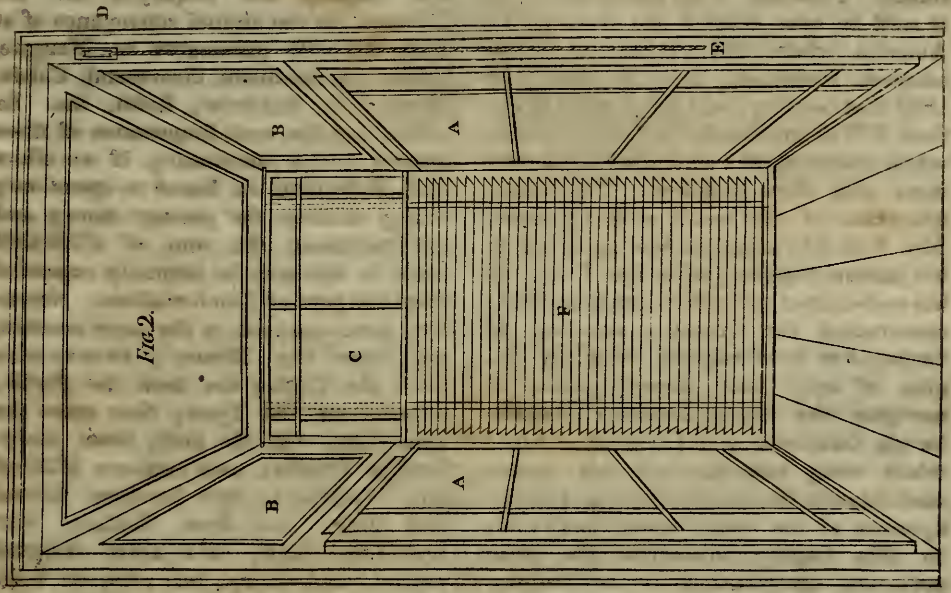

Fig. 2.

Swan Sc.

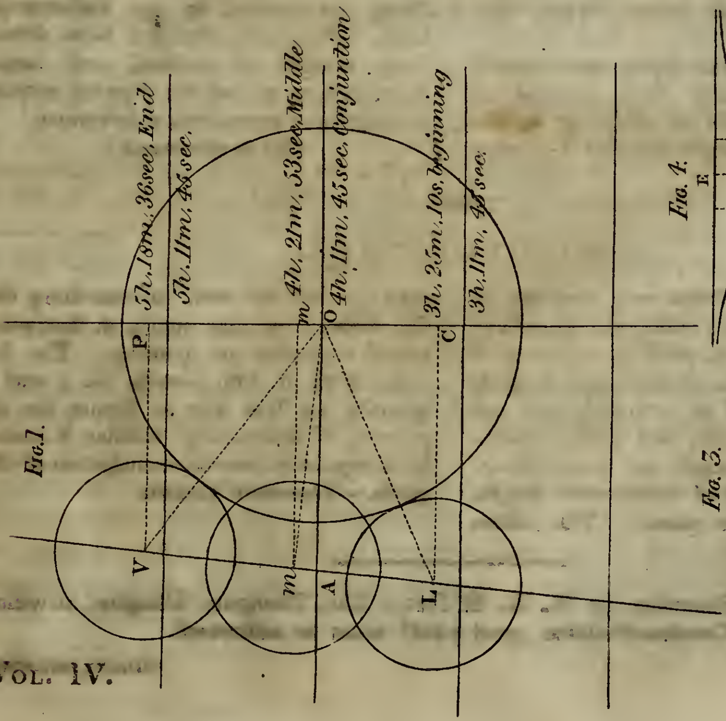

Fig. 1.

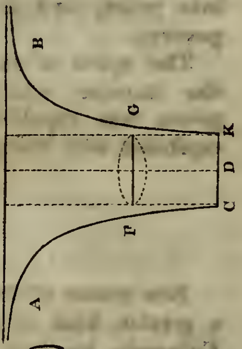

Fig. 4.

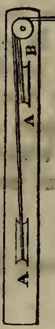

Fig. 3.

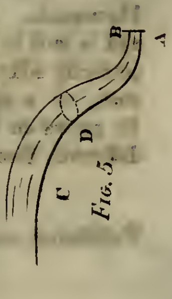

Fig. 5.

A CALCULATION OF THE LUNAR ECLIPSE TO TAKE PLACE ON THE 25th NOVEMBER, 1825.

By Mr. J. KINNISON, Schoolmaster of Lecropt.*

Conjunction at 11 minutes 45 seconds past 4 o'clock, P. M.

	° ′ ″
Let P represent the sun's hor. parallax,	0 8 7
p, the moon's do.	54 56
D, the sun's semi-diameter,	16 14 5
d, the moon's do.	14 58
$d\,☾ - d\,\bigcirc$ the relative motion in longitude,	28 0 4
$d\,l$, the true motion in latitude,	2 46 7
I, the inclination of relative orbit,	5 39 38
L, the moon's latitude in conjunction, N.	47 41 6

Here $\mathrm{O}\,m = \mathrm{L} \cos. \mathrm{I} = 47' 27'' 6$, the nearest distance of centres.

To find T, the time of describing A m.

$$\mathrm{T} = \frac{3600''\ \mathrm{L}\ \text{sine}\ \mathrm{I}\ \cos.\ \mathrm{I}}{d\,☾ - d\,\bigcirc} = 10'\ 0''\ 8$$

To find the $\angle$ U.

$$\text{Sine} \angle \mathrm{U} = \frac{\mathrm{O}\,m}{\mathrm{P} + p - \mathrm{C} + d} = 60^{\circ}\ 39'\ 25''$$

To find L m, the semi-duration.

$$\mathrm{L}\,m = \frac{(\mathrm{P}\,p\,\mathrm{D}\,d)\ 3600''\ \cos.\ \mathrm{I}\ \cos.\ \mathrm{U}}{d\,☾ - d\,\bigcirc} = 56'\ 43''$$

Hence the duration of the eclipse will be 1 hour, 53 minutes, and 26 seconds.

Also 4*h.* 11*m.* 45*s.* + 10*m.* 0*s.* 8 = 4*h.* 21*m.* 53*s.* the *middle* of the eclipse.

	h.	*m.*	*s.*
And from the time of the middle,	4	21	53
Subtract the semi-duration,		56	43
The remainder is the beginning,	6	25	10
Their sum is the end,	5	18	36

As in this case $\mathrm{L} > \frac{(\mathrm{P} + p) - (\mathrm{D} + d)}{\mathrm{Cos.\ I}}$ the eclipse will be partial.

The quantity of the eclipse is $\mathrm{P} + p - \mathrm{D} + d - \mathrm{O}\,m = 6'\ 59''\ 2$ of the moon's semi-diameter; or $2^{\circ}\ 49''$ digits of the moon's southern limb.

It may be proper to state, in this place, that the augmentation adopted by Myer has been used in this calculation. A smaller augmentation would have made the digits less.—The calculation is made for the meridian of Greenwich; and the results agree, within a few seconds,

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[*] For Projection of the Eclipse, see Plate, Fig. 1.

with those made under the direction of the Astronomer Royal.—The moon will set eclipsed at Nootka Sound, and she will rise eclipsed at Tunis, Tripoli, Toulon, Paris, London, Edinburgh, Glasgow, &c.

The eclipse will be vertical in longitude 114° 30′ E., and latitude 21° 32′ 29″ N. The course from Canton to the place is S. 40° 32′ 36″ E., and the distance $125\frac{6}{10}$ miles.

The phenomena of the eclipse, when reduced to the meridian of Glasgow, will stand as follows:—

	h.	m.	s.
Beginning at	3	8	3
Middle at	4	4	46
End at	5	1	20

The eclipse will be visible in all Asia, New South Wales, Madagascar, and the north eastern part of Africa, and almost all Europe.—Spain and Portugal, the south west of France, the south west of England, and Ireland, will not have it visible at the maximum.—Portugal and the west of Spain will have no eclipse at all.

JOHN KINNISON.

Lecropt School, 18th October, 1825.

PLAN FOR HANGING VENETIAN WINDOWS.

By Mr. SAUL of Lancaster.

GENTLEMEN,—In No. LXXIV. of your Magazine, I proposed to give in it such information on different subjects as I thought might not be generally known in other parts—hoping that some generous individual would have taken the hint, and followed my example; but I find, in No. LXXXIV. page 384, (Vol. III.) that your Correspondent, J.A., so far from following me, treats my idea with contempt. I beg to state, however, that I said no such thing as that I sent a new plan: I said what I sent might be new to some of your readers. I now send you for insertion, according to my promise, (as although my plan may not be agreeable to some, it may be to others,) the following mode for fixing Venetian blinds to a French window.

I was employed to hang Venetian blinds to two windows, 10 feet by 4, both in one room. The windows opened, of course, in the middle, had mahogany inside shutters, and looked into a garden. It was wished that the blinds should be so hung that they might remain down whilst the windows were open. The plan I adopted was this, and I trust my sending it to you will not offend any of your knowing ones about Glasgow. The upper part of the window (that is, as much of it as the length of the blinds when they were close drawn up,) was made fast, and did not open or shut like the lower part; and the upper portion of the shutters were likewise made fast, and did not close over the window at that part. The line by which the blinds were drawn up and down, was made to pass behind the fast part of the shutter to the architrave, and then passed over a pulley in the architrave, which pulley, with the cord, was concealed behind the drapery.

I am, yours, &c.
MATHIAS SAUL.

Explanation of the Plate.

Fig. 2, represents one of the windows, with the blinds and shutters. A, A, are the two leaves of the window, opened back against the shutters, which are about seven feet high; B, B, the fast part of the shutters; C, the fast part of the window. The blinds have not been shown here, that the fast part of the window might be seen; but the dotted lines show that the blinds should have been represented here as well as below. D, the pulley; E, the end of the cord; F, the blinds drawn down.

Fig. 3, is the top rail for the blinds. A, A, the pulleys for the cords to pass through the blinds; B, the pulley that directs the cord to the architrave.

ON THE HYDRAULIC PRESSURE OF A CONFINED CURRENT.

GENTLEMEN,—On this subject there are two opinions very different from one another; the more common is, that the pressure of a confined current on any opposing surface is equal to a column of water, whose base is equal to a section of the current, and height equal to that due to the velocity; while the other opinion, which is very partially adopted, is, that the column must be double the height due to the velocity. The latter opinion, for various reasons, appears to be correct.

Let A B C, (fig. 4,) be a tube of a form generated by the revolution of the curve A F C, about its axis, E D. Let the dimensions of the tube be such, that water flowing through it in a continuous current, shall have a velocity at every part, equal to that due to the depth below E.

Since the velocity at any section is inversely as that section, as the same quantity of water must pass through every section in the same time, and as this velocity is also as the square root of the height, if the sections of the tube be inversely as the square roots of the depths below E, the water will flow through the tube in a continuous current; whereas, if the diameter of the tube were uniform throughout, if the effect of atmospheric pressure be excluded, the continuity of the water would be interrupted, since the velocity is continually increasing downwards.

The sections being inversely as the square root of the depth, when the latter becomes great, so does the velocity, and the section is proportionally diminished; when the depth is very small, so is the velocity, and the section is then very great, so that the sides of the tube at the top expand outwards, approaching nearer and nearer to the horizontal line, but can never meet it, or its diameter at the top must be infinitely great.

Let s = any section,
r = its radius,
h = the depth from the top of the tube,
a = the velocity at s;

$$\text{Then } r^2 \doteqdot s \doteqdot \frac{1}{v} \doteqdot \frac{1}{\sqrt{h}}$$

$$\text{Or, } r^4 \doteqdot \frac{1}{h};$$ and the curve, A F C, is therefore a hyperbola of the fourth order. This tube seems to be the same as Newton's cataract, from which he proved that the velocity of a jet of water is that due to the height of the fluid above the orifice. This is very obvious in the case of this tube, which may be called the hydraulic tube.

But other conclusions may be deduced from this tube. It is obvious, from its construction and the laws of falling bodies, that the whole gravitation of every particle of water in the tube is at all times exerted in producing merely the velocity, and that no lateral pressure is at all exerted. If, therefore, any opposing force were applied at C D, to arrest the motion of every particle of water in the tube, that force must be equal to the gravitating tendency or weight of all the particles in the tube, since, from the velocity of each particle being that due to its depth, no pressure is exerted on the sides of the tube. It is not enough that the vertical cylindric column above C K be counterbalanced, the moving force of the particles contained between it and the hyperboloidal tube must also be counteracted, since, from the essential properties of fluids, the force of these particles is communicated through the vertical column. The counteracting force, and hence the reaction, pressure, or resistance, of the fluid, is equal to the weight of the whole water contained in the tube.

Let s = the capacity of the hyperboloid.
y = the radius at C K.
x = the height C D.
π = 3.1416.

Then $\int ds = \int \pi y^2 dx = \pi \int \frac{dx}{x^{\frac{1}{2}}} = 2\pi \sqrt{x}$. Now, the solidity of the cylinder, having C K for its diameter, and x for its height, is $\pi y^2 x = \pi \frac{x}{x^{\frac{1}{2}}} = \pi \sqrt{x}$.

Hence the capacity of the hyperboloid is equal to double the column, having C K for its base, and E D for its height, and the pressure of the fluid is also the same.—When the fluid in the tube is at rest, its pressure at C D is, however, only equal to the vertical cylindric column.

If the tube were entirely of a cylindric form, the continuity of the water must necessarily be broken as soon as the water begins to flow.

In the case of a jet flowing out from a large cistern, the pressure exerted must just be the same as in the hyperboloidal tube, since the current in both cases is continuous, and the velocity that due to the height; although, in the case of the cistern, the velocities of the horizontal strata will be uniform.

If a current of water flow over a fall, C D A, (fig. 5,) it is under exactly the same circumstances as in the hydraulic tube, and hence the pressure on the float-board, A B, must be double of that usually assigned. And in Smeaton's experiments on water-wheels, he found that the pressure was double that which the usual theory admits, although he attributed this increased pressure to a different cause.

If h = the height of the tube,
t = the time due to h,
v = the velocity;

Then, since in the time t, if the velocity, v, were continued uniform, a column whose length is = $2h$, would pass the orifice by the influence of the gravitating force constantly exerted; therefore, this force must just be equivalent to the weight of the mass falling through the orifice in the time t, or to a cylindric column having a base equal to the orifice, and a height equal to double that of the water in the cistern.

I am, yours, &c.

A. B.

Dollar, 1st Nov. 1825.

ON MR. ROBERTON'S PLAN FOR CONSUMING SMOKE.

Gentlemen,—In your Magazine, No. XCVII., I observe a long description of a plan for burning smoke, by Mr. Roberton, which I had previously seen taken notice of in some of the Glasgow newspapers, as a most ingenious plan for burning smoke. As an old mechanic, who was well acquainted with Mr. Roberton's father, who originally invented the plan, I have to inform you that it was invented 27 years ago, and included in a patent obtained by Mr. Roberton for another invention.* The plan was adopted by a good many at the time, and, among others, by myself; but after making trial of it, it was totally given up, on account of its destroying so much fuel, which must always be the case where a current of cold air is admitted above the fuel. To be brief, and, at the same time, show the uselessness of going so much out of the way to produce the mere effect of burning the smoke, I beg leave to inform you, that all that is necessary to accomplish this, in every common furnace, is only to keep the door up a little from the sole of the furnace, say within an inch, leaving that space open for air to enter in immediately after putting on fresh coals, and leaving it in this position for about five minutes, or according to the quantity of fuel put into the furnace, which can be easily ascertained by the engine-man at shutting down the door. If he does so too soon, he will immediately perceive the smoke by looking at the top; and he will soon learn the proper length of time to keep up the furnace-door. It thus appears that all such complicated plans of furnaces are unnecessary for the purpose of consuming smoke, besides being attended with extra expense of fuel, (which at present is an object not unworthy of attention;) because, as I have mentioned, every ordinary furnace can, with the greatest ease, be made to burn its smoke. To prevent mistakes, it is proper to mention that this plan, as well as Mr. Roberton's, destroys fuel; and that this is the reason I do not allow it to be adopted in my own furnace.

I am, yours, &c.
An Old Mechanic.

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* We were quite aware, and so is the public, that this plan was invented by the father; but has been improved by the son. —*Eds. Glas. Mech. Mag.*

DUNFERMLINE MECHANICS' INSTITUTION.

A general meeting of the inhabitants of Dunfermline, friendly to the formation of a Mechanics' Institution, was held in the Relief Meeting House there, on Tuesday the 20th of September last. The Right Honourable the Earl of Elgin in the Chair. Upwards of two hundred mechanics and others were present. The Rev. Messrs. Chalmers, Fergus, and Brand, successively addressed the meeting on the design and importance of the Institution, and Lord Elgin concluded with an animated speech to the same effect. The regulations, which we inserted in No. LXXXIX. of the present Volume, have been adopted, with the exception of the name of the Institution, which, instead of being designated the "Dunfermline School of Arts," as there proposed, has been styled the "Dunfermline Mechanics' Institution." The following is a list of the Office-Bearers for the ensuing year:

President.
The Right Honourable the Earl of Elgin.

Vice-Presidents.
James Hunt, Esq. of Pittencrieff.
The Rev. Peter Chalmers.

Treasurer.
Mr. Henry Inglis.

Secretary.
Mr. David Laurie.

Directors.

The Rev. Henry Fergus.
The Rev. George Bell Brand.
Messrs. Andrew Rutherford.
Alexander Robertson.
Andrew Peebles.
William Hunter.
William Ferguson.
Messrs. Alexander Pattison.
John Roxburgh.
John Scotland.
James Cumming.
James Allan.
Robert Bonnar.
Robert Hay.
William Meldrum.

IMPROVED STEAM ENGINE.

The following account of the new steam engine, invented in the United States by Mr. Babcock, is copied from a New England paper, the Providence Patriot, and is by far the most complete and scientific description that has yet been published:

"The invention of Mr. Babcock, which will probably supersede the necessity of a boiler to the steam engine, consists merely in converting water into steam at the moment it is wanted, by allowing it to come in contact with hot iron. To effect this, two generators are used, formed of iron tubes, cast in lengths of three and a half feet of five inches internal diameter, and an inch and a half thick; these are made to traverse a furnace horizontally, in two rows, and are fourteen in number; the lower seven are connected with each other by caps, and a steam pipe leads from the end of the last one into the lower part of the cylinder of a high pressure engine; the upper seven are connected in the same manner, and a steam pipe leads from them into the upper part of the same cylinder. At the other end of each generator, and on the opposite side of the furnace, is attached a small forcing pump, two and a half inches in diameter, and about eight inches in length. On the top of the furnace is a small copper reservoir, containing a few gallons of water, with a tube leading from each side of it, which connects it with the pumps. The furnace has two fireplaces, the one above, the other below, the tubes—its extreme outside length is eight feet—its height and width, each three and a half feet. The pumps are worked by long levers, attached to the cross head, so arranged as to move them alternately, and they can be made to inject from a half to four cubic inches of water at once, the whole of which, after performing its duty in the cylinder, is saved by a condenser. To set the engine in motion, a fire is kindled in the furnace, and when the generators are sufficiently heated, an injection is made by hand, with one of the pumps, (we will suppose into the lower generator;) the water is instantly converted into steam—a valve is opened to admit it into the lower part of the cylinder, and the piston is driven up: an injection is then made by the other pump into the other generator—a valve is opened in the top of the cylinder and the piston is driven down. The engine then, without further assistance, continues to operate with unabated vigour, and with perfect equality. The injection made into the generator, now in operation, is at most but four cubic inches; the cylinder of the engine, to which they are attached, is ten inches in diameter; the length of the stroke of the piston is three and a half feet, and it is calculated to be a ten horse power, though it varies in proportion to the quantity of water injected. The principle upon which the generators are constructed is an evident one; but the heretofore insurmountable obstacle has been, that they cooled so fast, by the constant injection of the water, that the requisite steam power could not be obtained by them: this is now completely overcome by using two generators instead of one, and having the injection pumps so arranged as to work alternately, that while the water is forced into one generator, the other has time to regain its expended caloric; and here consists the great merit of the invention; and the merit is the greater, because, though so simple, it has been entirely overlooked. We have been ourselves repeatedly witnesses of the perfect success of the operation, and the generators, so far from being cooled, are, with ease and celerity, made to acquire the requisite degree of temperature, even when the engine has commenced working with them at a low temperature.

"The economy of the substitution consists not only in space and weight, but in both wood and water. Had they not succeeded in the engine to which they were attached, it would have been necessary to have supplied their place by a boiler, twenty-two feet, at least, in length; the saving of force and weight is, therefore, three-fourths of what it would have been on the old plan; and instead of a cord of wood, which would have been consumed in four hours, there is now used but two feet in the same space of time: the saving in wood is, therefore, three-fourths; and last, but most important, instead of a condensed mass of scalding vapour constantly threatening death and destruction, there is now used but the small quantity of steam that can be generated from four cubic inches of water; and the simplest, the cheapest, and the most powerful, but heretofore dreaded, high-pressure engine, is made perfectly safe in its use and occupation. We do not say that it is absolutely impossible for the generators to burst; but were they to do so, no person could be injured, unless by a piece projected from it, and then so carelessly must they have been constructed, that a jury of the country could hardly help convicting their maker of premeditated manslaughter. As the public are apt to judge of the success of an experiment more from appearances than examination, we are sorry that the boat did not move with the velocity that was anticipated; but the fact is, that the engine was intended to move paddles of but 12 feet in diameter, instead of which, by an alteration in the boat, it became necessary to substitute paddles of 15 feet; as it is, they revolve seventeen times in a minute, carrying the boat full seven miles in an hour, while the Clermont, Fulton's first boat, went five miles in the same time. It should be remembered, too, that by first applying the invention to the propelling of a vessel, the most difficult method has been chosen of testing its power; and yet, with the peculiar obstacles it has had to encounter, we are assured not a doubt can exist with regard to it in the mind of any one at all conversant in the matter. We believe another era is about to take place in steam machinery, that will rank the name of Babcock with the illustrious one of Watt."

ON THE DISEASES INCIDENT TO MECHANICS.

By a Physician.

No. I. continued—On the Diseases to which Bakers are exposed.

In the Number of last week, we left off this article with mentioning the cutaneous affection arising from the irritating matters coming in contact with the hands of bakers.

This affection commences with little elevations of the cuticle, not readily observable, but easily felt—extremely itchy, and, in a few days, covered with scales, which ultimately form patches of varying extent, with clifts or chaps upon their surface. Sometimes they, *i. e.* the patches, assume a regular shape. Their most frequent seat is the back of the hand and fore-arm; but they are not confined to this spot, as the face, brow, legs, &c. are sometimes attacked by them.—There is little or no discharge from it, unless, as I have seen happen, it affect the parts so deeply as to assume the appearance of an ulcer.

Having now enumerated the diseases which it occurs to us the calling of bakers renders them incident to, we proceed to point out the

Means to prevent or relieve these Diseases.

It is a matter of great regret with some, and perhaps correctly, that much inconvenience attends the use of means calculated to prevent the inhalation of the fine particles of the flour floating in the atmosphere of a bakery. The envelopement of the visage in a napkin, spoken of by Pignorius, would not be tolerated by the workmen of the present day. It would, however, be ineffectual in the complete exclusion of these fine particles. To me, indeed, this matter is not of so much importance as those who see a great source of evil to the health of bakers in the inhalation of this fine powder. To other causes do I refer the maladies incident to this class. Ramazzini, after noticing Pignorius' plan, and its inefficacy, advises them to wash the face frequently with water; to make use of a gargle, consisting of honey, vinegar, and water; to use a mixture composed of honey and vinegar to allay the cough; to evacuate gently the stomach and bowels by purgatives and emetics. He adds, that the use of emetics has, in his own practice, snatched from a threatened consumption, many in whom the exercise of this trade had brought on cough, pain of chest, and difficult respiration. The first object, however, is to prevent the affections to which this trade exposes the workmen. The greatest source of danger I conceive (and that after no slight attention to the subject) to be, the alternations of temperature, and inattention to dress. It is, therefore, of the highest moment that those garments which keep up the most equable temperature, (such as flannel, worn next the surface of the body,) should be used by those employed in this trade; that the feet and legs be comfortably clothed; that, as far as they can conveniently, they should avoid exposures to sudden transitions of temperature, and certainly not go into the open air from hot bakehouses in the half-naked way we not unfrequently see them expose themselves; that they should avoid indulging in draughts of cold water, when heated; and that they should exercise the greatest temperance in regard to spirituous liquors, a matter inculcated both as a mean of prolonging life, and by moral considerations. Thus simply might the evils inseparable from this trade be alleviated, or modified so as to render its dangers trifling, and that by the simplest means—means which require no great sacrifices, amply repay by the comfort they afford, and procure an immunity from the greatest of all worldly woes—ill health. I have, in my own practice, experienced the greatest benefit in cases of incipient consumption, from the application of leeches to the chest, immediately under the collar bone—say from twelve to twenty, conjoined to the inhalation of the vapours of boiling water;* the use of some very gentle laxative; exercise in the open air, especially on horseback; and the use of a light but generous diet. Not unfrequently with the best effects, I have rubbed on a hand's breath of the chest the lotion, for which a formula is given below.† It has the effect of bringing out a copious eruption of pimples, whereby the internal complaint is relieved.—Cough mixtures, as they are called, are useful too; a very good and economical one is a decoction of marsh mallow root, and to it a little paregoric may be added, if necessary, to allay the irritation, and procure sleep.‡ The inhalation of the vapours of boiling water, keeping in bed, and drinking some mild warm fluid, will suffice for the removal of the slighter coughs and colds which are pretty frequent at this season.

A vast variety of remedial means have been used to cure the disease of the skin, which we have described above. Sometimes after a course of three or four months, it disappears; at other times it assumes so inveterate a form, as to baffle the powers of the constitution, and even the best directed efforts of medicine. Tar ointment; ointment made with the powder of the Coculus Indicus; ointments, composed of lard and corrosive sublimate, and other preparations of mercury, have all failed, and, in their turns, all succeeded; and it is astonishing what a variety of treatment even the same case bears—nay, requires. I have seen several cases cured by the tar ointment; but of late I have reaped much benefit from the use of an ointment, recommended by Dr. Chapman of America, in cases of scald head.* I always conjoin internal treatment with the above external application. I order a Plummer's pill every second night; and to keep the bowels open, small dozes (half an ounce dissolved in three gills of water, and repeated as occasion may require) of the polychrest salt. Of late the vapour bath has proved very useful in the hands of some physicians.

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* The inhalation of the vapours of boiling water is, in general, useless from the imperfect mode in which it is administered. We intend to describe, in some future Number, a machine admirably adapted to this useful purpose.

† Take of tartar emetic, one drachm; corrosive sublimate, five grains; common water, one ounce.—Dissolve. This is to be rubbed on the chest for a quarter of an hour thrice a day, till the eruption appear.

‡ Take of dried marsh mallow roots, bruised, four ounces; raisins of the sun, stoned, two ounces; water, seven pounds, (English pints;) boil down to five pints; strain the decoction; and after the grounds have subsided, pour off the liquor.

Take of the above decoction, two gills; paregoric elexir and wine of ipecacuan, equal quantities, one ounce, or a large table spoonful.—Mix; and take of this mixture a table spoonful on going to bed, or when the cough is troublesome.

* Take of sublimed sulphur one once; sal ammonaic, (powdered,) two drachms; hog's lard, one ounce.—Mix.

Thus have I made a few general observations on what I deem the most important part of professional advice—*prevention*. I have also added remedies in those cases where disease had actually supervened, and where some may deem it safe to "*doctor themselves*."

In the more urgent diseases of organic affection of the heart, or in cases of ulcers with varicose or large swollen veins running to them, and keeping up the irritation, we fear we should do more harm than good (our honest intentions in these remarks) to point out remedies, upon which, skill in their application and administration can alone command success. For those irritations of the eyes caused by the floury particles, frequent ablution of these organs with warm water is the best preventative; and to cure it, a weak solution of sugar of lead (a drachm in a choppin bottle full of water) is the best application. The eyes should be bathed four or six times daily for ten minutes at a time.

The diseases of a class of workmen, important as administering to the great republic of letters—the Printers—will form the next subject of our remarks.

REVIEW OF DR. THOMSON ON THE ATOMIC THEORY.

[From the London Journal of Science.]

(Continued from page 207 of the present Volume.)

In verifying atomic numbers by the method of mutual saline precipitation, had Dr. Thomson been careful to ascertain that the decomposition was complete, as he might have done by suitable re-agents, much more confidence might have been reposed in his labours. But he has very frequently neglected this essential precaution, as we shall show in the course of this examination of his work, and hence he has pretty often presented us with results, tallying well with the atomic theory, and with Berzelius, which he states as his own, though they could never have been derived from his narrated experiments. He has been also somewhat imprudent in quitting the solid track of precipitation, and of trying by *novel* methods, to demonstrate the truth of the idea suggested by Dr. Prout, that the atomic weights of all chemical bodies are multiples, by a whole number, of the atomic weight, of hydrogen.

> *Ceratis ope Dædalea*
> *Nititur pennis.*

The ingenious author of that proposition adduced so many examples, and analogies, as to render it highly interesting and plausible; and it has accordingly been regarded with a partial eye by the most eminent of our chemical philosophers. The beautiful law of gaseous combinations, discovered by M. Guy Lussac, and their densities to that of hydrogen being apparently in simple arithmetical proportion, naturally pointed to the principle so ably developed by Dr. Prout.

The proportion of the two elements in the composition of water, is by common consent regarded as constituting the ground-work of the atomic scale. Water is known to consist of one volume of hydrogen combined with half a volume of oxygen; and if this half volume be exactly eight times heavier than the entire volume of hydrogen, we shall have their atomic relation represented by these numbers. This half volume of oxygen, viewed as a component of concrete bodies, is estimated to weigh 1; phosphorus then weighs 1.5 and sulphur 2. But if that half volume of oxygen be contemplated in its gaseous state with reference to one volume of air as 1, or unity, its weight becomes 0.5555; and the atomic weights of the other bodies are brought into comparison with this gaseous standard, by reducing their atomic numbers in the ratio of 1.0000 to 0.5555. Thus phosphorus will become in the primitive combining volume of its vapour, $0.833 = 1.5 \times 0.5555$; and sulphur, $1.1111 = 2. \times 0.5555$.

In some cases, the concrete aspect of the oxygen atom, or prime equivalent

= 1, is convenient; in others, the gaseous aspect = 0.5555. They are, however, merely different forms of the same proposition; nor can the arithmetical reduction of the concrete unity to the pneumatic expression, be considered, with Dr. Thomson, as a *law of combination.* In fact, the assumption that half a volume of oxygen constitutes one atom, *versus* an entire volume of hydrogen, is altogether arbitrary, and merely a matter of convention among chemists.

We are acquainted with no body, contemplated in its gaseous state, which unites with less than its own volume of hydrogen. Most bodies, on the contrary, which combine with hydrogen, do so in the same proportion as oxygen does; that is, they take twice their volume of this inflammable gas. Now, if the densities of hydrogen and oxygen gases are as 1 to 16 exactly, then from the known relations of oxygen to other bodies, it will not be difficult to show, that their atomic weights will be all, very nearly, if not exactly, whole numbers, or multiples of hydrogen = 1. Thus we perceive carbon to be 6, oxygen 8, phosphorus 12, nitrogen 14, sulphur 16, &c.

Dr. Thomson, in his "Historical Introduction," considers Mr. Dalton's choice of the atom of hydrogen for unity, as unhappy; asserting, that with the exception of Dr. Henry, of Manchester, and one or two chemical gentlemen in London, "this method has been rejected by almost all the British chemists, and by all the chemists without exception in Europe and America." The Doctor's reasons are thus stated: "1. Because the atom of hydrogen is the most difficult of all to determine; and chesmist are not yet all agreed about its weight. 2. Hydrogen, so far as we know at present, combines with but few of the other simple bodies; while oxygen unites with them all, and often in various proportions. Consequently, very little advantage is gained by representing the atom of hydrogen by unity; but a very great one, by representing the atom of oxygen by unity. For it reduces the greater number of arithmetical operations respecting these bodies to the addition of unity; and we see at once, by a glance of the eye, the number of atoms of oxygen which enter into combination with the various bodies. Thus, if the atom of manganese be represented by 3.5, and the weight of the various oxides of that metal be as follows:

1. Suboxide	4
2. Protoxide	4.5
3. Deutoxide	5
4. Tritoxide	5.5
5. Manganesious acid	6.5
6. Manganesic acid	7.5

It is obvious at once that the

Suboxide contains	½ atom ox.
Proxide	1
Deutoxide	1½
Tritoxide	2
Manganesious acid	3
Mangenesic acid	4

Whereas, if we were to make the atom of hydrogen unity, these weights would be as follows:

Manganese	28
Suboxide	32
Protoxide	36
Deutoxide	40
Tritoxide	48
Manganesious acid	56
Manganesic acid	64

Numbers, which would not suggest the number of atoms of oxygen contained in each, with the same facility." *

The first reason given by Dr. Thomson applies with equal force to oxygen, for its relation in atomic weight to other bodies is little better known than that of hydrogen to them. The proportional weights of these rival elements are always inferred from the composition of water; and whatever relation be discovered between them, it will pervade the whole system of bodies which have for a constituent either hydrogen or water. In Mr. Dalton's original numbers, published in 1808, the atomic relation of hydrogen to oxygen in water is 1 to 7; and therefore to reduce all the numbers to the oxygen unity, they have only to be divided by 7. No error will be introduced into the resulting numbers, by having taken the hydrogen unity, provided the analyses of the oxides and oxygen acids have been exact. Again, if water be supposed to consist of 1 part hydrogen to 7½ oxygen, as on Dr. Wollaston's scale, surely this synoptic table would not have its accuracy affected by reducing the numbers to a hydrogen unity; for the relations of oxygen to the other bodies, being deduced from their proper authorities, would stand as before.

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* Historical Introduction, p. 14.

Hence it is obvious that the system of atomic weights derives no immunity from error, by calling oxygen 1, and hydrogen 0.125. The following manifesto of Dr. Thomson is therefore founded on a false conception; "whereas, if we make choice of oxygen for our unity, any error respecting the atom of hydrogen will be confined to that atom, and will not affect the accuracy of the atomic weights of other bodies." * On the contrary, an error respecting the hydrogen atom will affect the atomic numbers of all the hydrogen acids and hydrates, under which title rank most of the free acids, a great proportion of the salts, and all the organic products.

The second reason assigned by Dr. Thomson, that hydrogen combines with but few of the other simple bodies, is a very singular one; for hydrogen forms a variety of most interesting compounds with all the simple bodies non-metallic, as also with some metals, while its compound, water, is of almost universal agency.

Three advantages accrue from the assumption of hydrogen, as the atomic unity. 1. We get rid of numbers less than unity in the scale of equivalents. 2. We avoid fractional quantities throughout the whole range of atomic numbers. 3. The atomic numbers in the hydrogen scheme, exhibit for the most part in reference to that gas, the specific gravities of the chemical bodies supposed to be in the aëriform state; and the combining ratios of their weights, under the same volume, are made manifest to the eye. This is a capital advantage in all researches on the gases, or on bodies which afford gaseous products in analysis. Let us consider this proposition, in reference to a few leading chemical bodies, carbon, phosphorus, azote, and sulphur.

1. Subcarburetted hydrogen gas is, as its name indicates, a compound of one volume vapour of carbon + 2 volumes of hydrogen gas; the weight of which are $6 + 2 = 8$; which sum, from the 3 volumes, being condensed into 1, is its specific gravity, compared to hydrogen $= 1$.

2. Carburetted hydrogen or olefiant gas. A volume of this compound consists of 2 volumes hydrogen + 2 volumes carbon, whose weights are $2 + 12 = 14$; and as these 4 volumes become 1 volume of the compound gas, the specific gravity of this will be 14, if hydrogen is 1.

3. Phosphuretted hydrogen results from 1 volume of phosphorus $= 12$ + 1 of hydrogen $= 1$, constituting 1 volume, whose weight is 13, being the specific gravity, as well as atomic weight, of the aëriform compound on the hydrogen scale.

4. Subphosphuretted hydrogen is composed of 1 of phosphorus $= 12$ + 2 hydrogen $= 2$, constituting 1 volume, whose weight is 14. This is at once the atom and the density.

5. Hydrogen with azote, or ammonia. This compound consists of 1 azote $= 14$ + 3 hydrogen $= 3$, whose joint weight is 17; and as these 4 volumes compose 2 of ammonia, the resulting specific gravity will be $\frac{17}{2} = 8\frac{1}{2}$ times that of hydrogen. The specific gravity becomes here one-half of the atomic weight.

6. Hydrogen with azote and carbon; the prussic, or hydrocyanic acid. This body consists of 2 carbon $= 12$, + 1 azote $= 14$, + 1 hydrogen $= 1$, whose sum is 27; which 4 volumes together constitute 2; therefore the specific gravity is $\frac{27}{2} = 13\frac{1}{2}$ times that of hydrogen; while the atom is the double.

7. Cyanogen, or bicarburet of azote. It consists of 2 carbon $= 12$, + 1 azote $= 14$, whose sum is 26; and as these 3 volumes form 1, its specific gravity will be 26 times that of hydrogen.

8. Sulphuretted hydrogen. This is composed of 1 sulphur $= 16$, + 1 hydrogen $= 1$, whose sum $= 17$, is the specific gravity of the gas compared to hydrogen, for the hydrogen does not change its volume in combining with the sulphur; or a volume of hydrogen gas and one of vapour of sulphur compose one volume of sulphuretted hydrogen gas.

When oxygen is contemplated in the general relations of weight and volume to hydrogen, we must bear in mind the hypothetical assumption at the root of both schemes of equivalent numbers; viz., that half a volume of oxygen $= 8$ is the primitive combining proportion. If we regard water as consisting of 2 volumes of hydrogen + 1 of oxygen, the entire volume of oxygen becomes 16, and therefore we shall have $2 + 16 = 18$ for the total weights; and as these 3 volumes of constituents form 2

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* Historical Introduction.

volumes of aqueous vapour at 212° Fahr., we shall have its density $\frac{18}{2} = 9$, and if hydrogen be called 0.0694 in reference to air = 1, the vapour will become 0.625 = 9 × 0.06944. As the density is here compared to air of the same temperature, the relation of 0.625 to 1 will continue through the thermometric range, since vapours out of contact of their liquids, and gases, suffer the same change of volume by change of temperature. The diminished specific gravity of the vapour will be therefore simply proportional to its diminished tension or elastic force.

The preceding exemplification of the value of the hydrogen *radix*, will, we trust, satisfy our readers, that Dr. Thomson must have formed a somewhat crude conception of chemical equivalents, when he talks so slightingly of that atomic scale. He should reserve his dogmatic decisions for more *tangible* matters. In a word, let any practical man compare the hydrogen and oxygen scales in reference to the water of crystallization of salts, and he will readily find that 9 and its multiples, are much more manageable than the multiples of 1.125.

But the Doctor is not content with reasoning alone; he must needs exemplify, and his manganese case is a droll enough proof of the very great benefit (to himself) "of representing the atom of oxygen by unity, for it reduces the greater number of arithmetical operations, respecting these bodies, to the addition of unity." When a gentleman's arithmetic extends no farther than the addition of unity, assuredly Dr. Thomson's plan is the only safe one; and he illustrates with peculiar *naiveté* the intricacy of the other plan, in which hydrogen being called 1, oxygen assumes the formidable magnitude of 8. On multiplying the following quantities of his favourite scale, viz., 3.5, 4, 4.5, 5, 5.5, 6.5, and 7.5, by that unweildy number 8, he has committed three blunders; his products being, as we have quoted them above,

$$\left.\begin{array}{l}28\\32\\36\\40\\48\\56\\64\end{array}\right\}\ \text{instead of}\ \left\{\begin{array}{l}28 = 3.5 \times 8\\32 = 4 \times 8\\36 = 4.5 \times 8\\40 = 5 \times 8\\44 = 5.5 \times 8\\52 = 6.5 \times 8\\60 = 7.5 \times 8\end{array}\right.$$

We shall no longer be surprised at Dr. Thomson's antipathy to the hydrogen scale; though to a student somewhat advanced in simple addition or multiplication, a short succession of 8's will not be found very difficult to link together. Were we anxious to rest our cause on the authority of names, as Dr. Thomson has tried to do, we would adduce as its patrons, Sir H. Davy, Mr. Dalton, Dr. Prout*, Dr. Henry, Mr. R. Philips, and many other chemists, who prefer the hydrogen to the oxygen *radix*. Since the atomic theory is an indigenous plant, whose habitudes and cultivation have been but partially studied abroad, we cannot allow to the opinions of continental chemists much weight in the discussion.

(*To be continued.*)

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* "There is an advantage in considering the volume of hydrogen equal to the atom, as in this case the specific gravities of most or perhaps all elementary substances (hydrogen being 1) will either exactly coincide with, or be some multiple of the weights of their atoms," &c.—Dr. Prout in Ann. of Phil. vii. 113.

REMARKS ON THE PROGRESS OF STEAM NAVIGATION.

By WILLIAM BAIN, Master in the Royal Navy, and Commander of the City of Edinburgh Steam-Packet.

(Continued from page 208 of the present Volume.)

NOTWITHSTANDING the rapid and successful improvement of steam navigation, it was not till the year 1818 that it dared to venture beyond the limits of river or inland navigation. In that year the *Rob Roy*, of ninety tons, built upon a new principle, by Mr. Denny of Dumbarton, furnished with an engine of thirty horse power, made by Mr. Napier of Glasgow, first passed the bounds formerly prescribed by inexperience; and at once astonished and delighted the world, by affording a safe and economical mode of conveyance between Greenock and Belfast, a distance of about a hundred and twenty miles.

In the following year, (1819,) the Talbot, of still greater dimensions, and with a higher steam power, began to ply between Dublin and Holyhead, and in the outset successfully encountered many very severe gales. The spirit of enterprise for this navigation now began to burst forth with increased energy, particularly on the banks of the Clyde. The Ivanhoe, Belfast, Robert Bruce, Waterloo, Eclipse, Superb, Majestic, and Cambria, were all constructed on a scale of large dimensions, and with engines of greater power than heretofore, calculated to sail from the Clyde to the distant ports of Greenock, Belfast, and Liverpool. The City of Edinburgh, on a scale of still greater magnificence and grandeur, was also launched this year, and her track of navigation first proved the practicability of making a safe and expeditious passage by steam upon the high seas, between the ports of London and Leith, a distance of about 400 miles. In the same year the steam-packet Tourist, (then under the command of the writer of this article,) in out-running the mail-coach by ten hours, in the distance between Edinburgh and Aberdeen, induced government to adopt a quicker despatch for the mail upon that road. During the following year (1820) the *James Watt,* another very superb steam-packet, a vessel highly creditable to the talents of her *engineer,* and to the liberality which has always marked the patriotic proceedings of the Leith and London Joint Stock Company, to which she belongs. The St. Patrick and St. George, of Liverpool, were also soon afterwards built upon a similar scale of grandeur, under the able direction of Mr. William Laird. The Swift, of Leith, formerly a sailing smack, was, at this time, fitted up as a steam-packet, and first opened the passage between Brighton and Dieppe in France; then came the Lord Melville and Talbot, between London and Rotterdam. Ferry-boats propelled by steam, and suited more immediately to local situations, were established about this time upon the Mersey, Tay, Forth, Severn, Humber, and other navigable rivers and arms of the sea.

Since the year 1820, many other steam-vessels of various dimensions and power have been launched at different ports within the kingdom. From Hull, two of these sail twice a-week for London; and the Post-office department employs steam for the conveyance of the mail, wherever it is found safe and practicable. The Soho, surpassing all her predecessors in magnitude and in the elegancy of her accommodations, has stamped an additional value on the facilities of intercourse between London and Edinburgh. From the former capital to Ramsgate and Calais, beautiful packets, called the Lord Liverpool, and City of London, have also been lately fitted out. Indeed, such is the avidity and enterprise in promoting this system, that few ports of any consequence in the united kingdom will ere long be without one or more of these vessels. Government has also, latterly, attached to each of the dock-yards one or more steam-vessels, of the most substantial build, and of great power, for towing ships of war out and into harbour; and thus, at the distance of nearly a century, are we at this day only making use of one of the leading objects of the patent of Mr. J. Hulls. To a great maritime nation, where a ship, squadron, or fleet may often be required to put hastily to sea, an establishment of this kind must be of incalculable value for towing vessels out of the Medway, Portsmouth, and Plymouth. Nothing can be more necessary for the service, or more desirable to the ardent spirits of the officers and crews of his majesty's ships, when thwarted with contrary winds while impatient to meet an enemy, and therefore, even in a political point of view, steam navigation is calculated to prove a most valuable acquisition to the British Navy.

(To be continued.)

HEALTH AND LONGEVITY.

The description which we have of the primitive ages is, that mankind were then robust, of hardy constitutions, scarcely ever visited by sickness, and lived hundreds of years: on turning from them to the history of modern times, we are appalled by accounts of the ravages of every species of disease, the precarious tenure of health, and the very limited period of existence. An individual who has only reckoned four score years since his birth, is now seen stooping under the load of his infirmities; all his faculties, mental and corporeal, impaired, and rapidly decaying; his head sparingly covered with the silver tokens of a long life; and he has already become of little, if any, utility on earth. In times of old, after having lived upwards of two hundred years, man was still in the days of his youth; his body had but about this time, perhaps, acquired its exact proportions,—his limbs were lithe and vigorous—and his whole corporeal, as well as mental, system, sound and unenervated; and, perhaps, he might enumerate two hundred years more of his earthly pilgrimage, ere he bethought him of taking a wife, and propagating a family, to continue his name to future ages; and after having lived six or seven hundred years, and witnessed the deeds and worldly aggrandizement of his children—perhaps his children's children—then, in

" ~~~~~~~~~~~ a calm old age,"

did he placidly resign his spirit to Him who gave it, and "was gathered unto his people." Strange and very striking is the contrast! The world has not changed since these days, nor is the present generation other than the descendants of these primitive fathers, and yet why has mankind become so degenerated, so liable to disease, so short-lived, so enfeebled?

Of one thing we are assured, that with the progress of refinement has always been connected every manner of vice. Our primitive fathers, we have said, were healthy. Health and a long life are two apposite principles, and universally assimulated to each other. They, however, depend materially, I might say entirely, upon the regard which we pay to them. In the history, therefore, of the primitive ages, we find that vigorous and active exercise and employment were the characteristic features of our ancestors. The beneficial and enervating effects of exercise upon the human frame is so universally known as to require no comment. They were much in the fields and open air; and, of course, much exposed to every change of atmosphere. Air, of itself, is known to have an invigorating influence; and when the body is properly exercised, is peculiarly bracing and invigorating: and, finally, they subsisted on nature's wildest productions—the coarsest food—the spontaneous bounties of their mother earth, and were clothed correspondingly, without regard to ornament and unnecessary ostentation. The mountaineer even of the present day, whose rude mode of life has not yet been tainted with the improvements of civilized society, and who is a stranger alike to want and to wealth—he, in the undisturbed enjoyment of his rural pastime, among the wilds of his native home, and in providing for the necessities of his family by manual labour, seldom knows either sickness or disease. He is inoffensive, he is honest, and he is even kind. But it is the increase of knowledge, it is the spread of civilization, which will, perhaps, one day render him unhappy, and even wretched. The days of health—of long life—are fled before us; the body is now pampered to loathsomeness; the mind is enlightened to do evil; and man is subjected to every species of disease, to misery, and ultimately—after but a few days' existence—to death. It is, we conceive, "the *last* end of man" to bestow much thought upon the state and keeping of his body, although, from the unlimited introduction of every indulgence, such attention has now become almost a matter of conscience. To describe the regimen to be attended to, is not the purpose of this paper. The body is constructed so as to require little sustenance; but man has, forgetting the end of his being, fallen into the most egregious folly, by pampering it with every variety of luxury, and glutting it even to excess, which is frequently, if not always, with other circumstances of irregularity, the sole cause of disease, and of a short life.

As the preceding remarks can only, in a manner, be considered as introductory, I am induced to conclude this paper at present, Gentlemen, with the expectation of shortly laying before you a freer investigation of the subject which we have prefixed as our title.

CURIOSUS.

NOTICES TO CORRESPONDENTS

Dixon Vallance, Liberton; M. H.; L. M'L.; A Reader, Whitehaven; R. W., Dunbar, &c. have been received.

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"We ought not, like the spider, to spin a web from our own resources; but, like the bee, visit every store, and choose the most useful and the best!"

No. CI. *Saturday, 26th November*, 1825. Price 3*d*.

SITOMETER, OR INSTRUMENT FOR MEASURING GRAIN, PERPETUAL MOTION, &c.

Fig. 1.

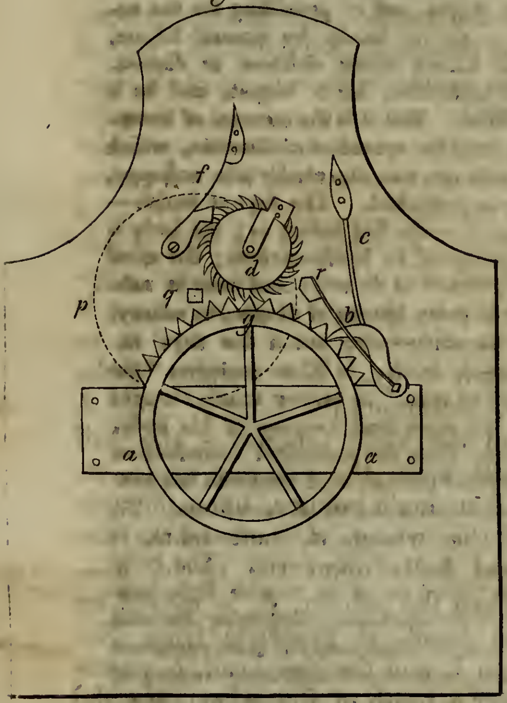


Fig. 2.

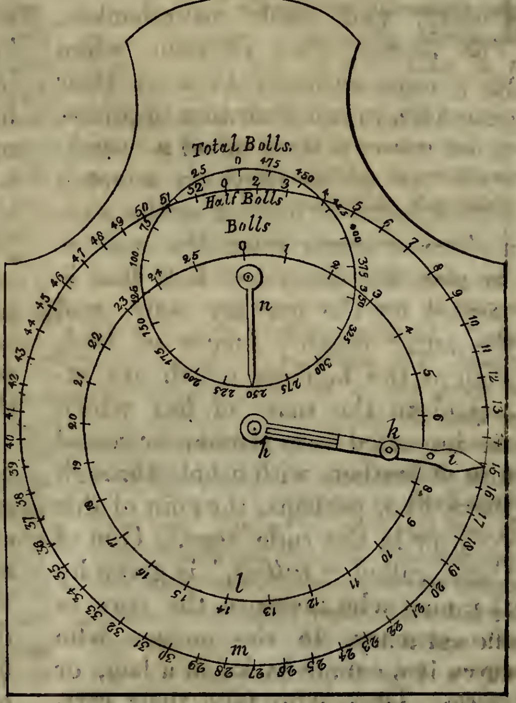


Fig. 8.

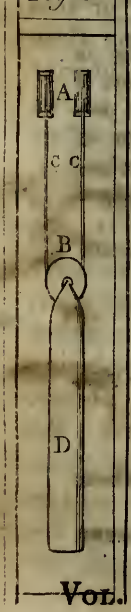


Fig. 4. *Fig. 5.* *Fig. 6.* *Fig. 7.*

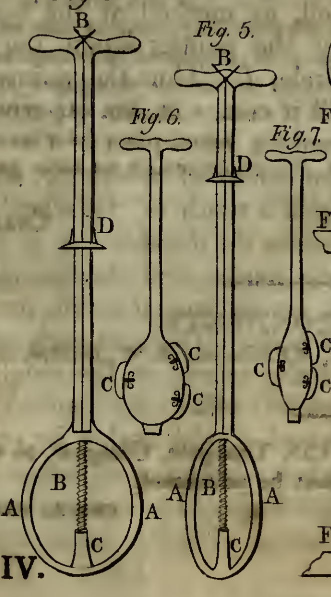
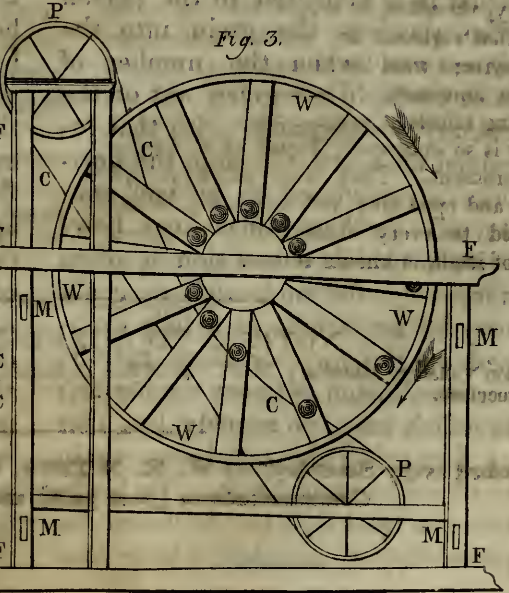


Fig. 3.



—Swan. Sc.—

DESCRIPTION OF A SITOMETER, OR INSTRUMENT FOR MEASURING GRAIN.—By HENRY STEFFEN, Esq. Balmader.

[From the Edinburgh Philosophical Journal.]

It must appear evident to every one who has paid any attention to the business, that the mode adopted by farmers and corn merchants for marking the quantities of grain which they lay up in their granaries, or put on ship-board, is very clumsy, and liable to mistakes. The former class of men, when they have occasion to store their granaries, to suit their idea of prices, make use of a stick called a "*nick-stick*," in which they cut a notch with a knife, or make a stroke with a piece of chalk upon the wall or fanners, for every half boll that is carried up the granary stair; and the latter employ pieces of lead, such as the bobbins which are attached to the mats of flax which are imported from Russia, or round bits of leather, with a hole through them, like, perhaps, the coin of this country in the rude ages. One of these, called "*tallies*," is given by the men who measure the corn in the granary, to the porters who carry it on their backs in a bag, or to the carters who take their cart-loads from the granary to the ship, when it is delivered to the person who receives the grain into the ship; and when the number of *tallies* which are given out of the granary, corresponds with that received on board the ship, the business is considered to be well conducted. In these proceedings, however, in which expedition is often necessary, the nick-stick or chalk may be neglected, or a tally dropped on the way, or there may be some collusion between the parties; in which case, no remedy but that of measuring the grain over again can be had recourse to. To facilitate the marking, and to lessen the probability of mistakes, I have contrived a simple machine, of which the following is a sketch, and a description of its mode of acting.

Let *a*, *a*, (fig. 1,) be a deep-toothed wheel, of any number of teeth, *b*, a dog-head, and *c*, a spring to stiffen the hold of the dog-head on the teeth. *d* is another wheel, but the teeth are bevelled, and of less diameter than *a*, with its dog-head, *e*, and spring, *f*. *g* is a spike upon the wheel, *a*, to act upon the teeth of the wheel, *d*, when *a* makes a revolution. In fig. 2, *h* is a pointer, attached to the axle of the wheel, *a*, with its point exactly opposite to the spike, *g*, and upon it is a slider, *i*, with its nut, *k*, to fasten it by. The pointer marks the bolls upon the interior circle, *l*, and the slider indicates the half bolls upon the exterior circle, *m*. *n* is a single pointer, upon the axle of the wheel, *d*, and marks the total bolls upon the circle, *o*.—When the pointer, *h*, is moved by the hand, it proceeds from No. 0 to 1, and the dog-head, *b*, passes over a tooth of the wheel, *a*; the next motion of the pointer marks 2; that is, two half bolls, or one boll, as marked at the same time by the pointer upon the interior circle, *l*. Thus the pointer marks till it comes to No. 50, when it has made a revolution of the wheel *a*, the spike of which, *g*, then acts upon a tooth of the wheel, *d*, and causes the dog-head, *e*, to pass over one tooth; and the single pointer, *n*, marks from 0 to 25, the number of bolls. Thus, at each revolution of the wheel, *a*, the single pointer marks other 25 bolls, till the wheel, *d*, also makes its revolution, when the number marked will be 500 bolls. Hence, by increasing the number of teeth in the wheels, the number of bolls will also be increased; and when the machine has to be used at a new heap of corn, the pointers can be set by the hand at No. 0. When the machine is thus used, the farmer or corn-merchant can, at one glance, see the quantity of grain measured up in his absence; and if he is desirous to know whether his servants are working industriously, let a well-sounding bell, (fig. 1,) be attached at *q*, and its hammer, *r*, be fixed upon the axle of the dog-head, *b*, then, for every half boll marked by the pointer, *h*, the hammer will give an audible stroke upon the bell; the ringing of which may be heard by the merchant in his counting-room, if situate near the premises. The ringing of the bell will prevent any chance of a mistake being committed through neglect, as its sound will be distinctly heard above the noise of the fanners, even on a wooden floor.

Such a machine may be constructed at little expense, and it may be fitted up in a box, to be taken where used, or fixed against the wall at a convenient place. The one I use, though made of brass, and a first attempt, cost only a few shillings. The scale of the above sketch is $\frac{3}{10}$ths to an inch. I am convinced, if farmers and corn-dealers would use it, they would find it a very convenient little machine. If so humble an instrument deserves a fine name, I would call it *the Sitometer*.

PERPETUAL MOTION.

By Mr. Dixon Vallance, Liberton, Lanarkshire.

Gentlemen,—Your valuable and widely circulated Magazine is read by many, who, like myself, have been in pursuit of that *ignis fatuus*, the perpetual motion, and although Miss Spunkie has hitherto defied "the best laid schemes of mice and men," and still appears to leap about as light and sportive as ever, let us have at her again. The prefixed drawing shows how I have at length taken this enticing jilt, though after a long and weary chace

> Through pleasant and delightful fields,
> Through barren tracts and lonely wilds;
> 'Mongst quagmires, mosses, muirs, and marshes,
> Where deil or spunkie never scarce is!
> By chance I happened on her den,
> And took her when she didna ken.

Description of the Plate.

W, W, W, W, (fig. 3,) represents a wheel with twelve hollow spokes, in each of which there is a rolling weight or ball. *c, c, c, c*, is a chain passing over two pulleys, P, P. There is an opening round the wheel from the nave to the circumference, so as to allow the chain to pass freely, and to meet the weights. The weights are met by the chain as the wheel revolves, and are raised from the circumference till they are at last brought close to the nave, where they remain, till, by the revolution of the wheel, they are allowed to roll out to the circumference. By this arrangement, the weights are, on one side only of the wheel, always at the circumference, so that that side is more powerful than the other, which causes the wheel continually to revolve. F, F, F, F, is the frame of the machine; M, M, M, M, the mortices for joining the two sides of the frame by cross rails. The arrows point out the direction in which the wheel turns.

I am, yours, &c.
Dixon Vallance.

Liberton, Lanarkshire, 10th Nov. 1825.

INSTRUMENT FOR BORING SPHERICAL CHAMBERS IN WOOD, &c.—By Mr. Dixon Vallance, Liberton, Lanarkshire.

Gentlemen,—I send you a plan of instruments for boring spherical chambers either in wood or metal. Figs. 4 and 5 represent the instruments for boring wood or soft metal. They are wrought by turning round the handle. The cutting edge, A, A, is made of spring steel, and is bent out, as it cuts, by the screw, B, B, which screws into the socket, C. D is a sliding ring, which is fixed by a screw, for regulating the depth of the chamber. Figs. 6 and 7 are wrought by beating the instrument against the bottom of the hole, which makes the springs with the cutters, *c, c, c, c*, screwed to them, bend out. This instrument is for making chambers in rocks, for blasting.

I am, yours, &c.

Dixon Vallance.

Liberton, Lanarkshire, 10th Nov. 1825.

IMPROVED MODE OF HANGING WINDOWS.

By Mr. Saul, Lancaster.

Gentlemen,—I send you, for insertion in your Magazine, a plan for hanging windows, by which one plumb or weight will answer for both top and bottom sashes. I believe this mode will be found to be better than the usual mode of having a weight for each; and, from personal observation, I have found that the cords last much longer than on the ordinary plan.

The cord, C, C, (Fig. 8,) is fixed to the two window sashes, the one end of it to the upper, and the other end to the under sash. The cords pass over the two pulleys at A, and pass through the other pulley at B, which is fixed to the weight, D. The weight thus moving by the pulley, B, on the cord which is attached to the window sashes, is moved up and down, as either of these is raised or lowered, and thus, with only the additional expense of the pulley at B, answers the purpose of two weights.

I am, yours, &c.

Mathias Saul.

Lancaster, Nov. 1825.

ON LESSENING THE DRIFT OF SHIPS AT SEA.

A Mr. Burnet of London has taken out a patent for this purpose. It consists in letting down to the windward a square plane, attached to a floating plank, with chains eleven feet long, from the angles at one side, to those at the opposite sides, connected in the middle by a loose ring, to which a hawser is to be fastened from the ship; a cord also passes to the ship from each end of the plank, to direct the position in which this is to lie with respect to it. The square plane being directed by the cords to lie at right angles to the drift of the ship, and not being moved by the wind, from lying very low in the water, will, of course, in being drawn forward by the hawser, make a resistance to the motion of the ship to the leeward, proportional to its hold in the water, which will be equal to its surface multiplied by the square of the velocity of its movement.

The square plane consists of a frame of bar iron, bolted to the plank with strong canvas, turned over and sewed to the upper bar of the frame, and laced by cords passing through holes in it, to the bottom bar, and to those at the sides. The plank is a little more than three times the length of the frame, and is formed of three pieces, united by hinges at each side of the frame, with bolts over the hinges, so arranged that when the two outside pieces are opened up so as to be in a line with the middle piece, the bolts being protruded, will keep them in that position; and when they are drawn back, will admit those pieces to be brought down by the sides of the frame, in order that the whole may take up less room in stowage, when not required for use. The chain connected by the ring in the middle, and drawn by the hawser, will pull the whole forward equally, without permitting one part of the frame to be acted on more than another by the resistance of the water. The dimensions of the frame are not mentioned, but from the length of the chains being eleven feet, it is supposed it could not be more than about seven feet long at each side.

This plan was first proposed by Dr. Franklin, who took the idea of it from a school-boy's kite, and had an apparatus for the purpose fitted up in the same manner, and very like one, an account of which may be seen in the Transactions of the American Philosophical Society.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION VII.—*continued.*

2.—*Oxymuriate of Potash.*

When the simple gas, and also water impregnated with it, were mostly given up, oxymuriate of potash, or soda, came to be used, as we have already seen in the history. The preparation of the bleaching liquor with these is precisely similar to that employed in the impregnation of water; the leaden receiver being, in the former case, filled with a solution of one of these alkalies. The experiments of Mr. Rupp and others, to prove that the detergent power of chlorine is diminished by neutralizing it with an alkali, have been found practically erroneous. It is not unlikely, indeed, that they were deceived by the circumstance of the oxymuriates not producing so sudden an effect as the pure chlorine; but this is rather an advantage than otherwise, for the chlorine is disengaged so slowly and gradually from these salts, that time is given it to act equally and effectually on every part of the cloth. Little is lost, consequently, which is so copiously emitted by the escape of gas in the former case; and the operation is also rendered more healthy to the workman.—Lately the combination of chlorine with the mineral alkali has been much used in the calico manufacture, for clearing the whites of maddered goods, and it has almost superseded the tedious and expensive process of crofting. It is used in a state of great dilution, for although a strong solution would clear the whites more rapidly and more effectually, yet care must be taken not to make it strong enough to affect the colours which are to remain fast on the piece.

The strictest attention ought to be paid to the purity of the alkali used for making oxymuriates, as, if it be contaminated with neutral salts, the chlorine is not all taken up, and that which is left in an uncombined state being greatly stronger than that which unites with the alkali, it will attack the colours of the printed goods, and in all probability discharge them.

3.—*Oxymuriate of Magnesia.*

Sir Humphrey Davy found by experiment that the texture of linen was considerably injured when immersed in a hot solution of chlorine and water, by the corrosion, as he supposes, of the muriatic acid. Now this, he justly thinks, decreases considerably the advantage of the speedy and effectual bleaching which is thus produced. To remedy this, he instituted a set of experiments, and was so fortunate as to discover a substitute wholly free from this inconvenience, namely, the oxymuriate of magnesia. This may be procured by the method already described, by diffusing the magnesia through the water in the receiver, with which the chlorine combines and becomes condensed. It acts much more slowly and gradually than any of the other compounds of chlorine employed for the same purpose, and, consequently, must produce a more equal detergency. At Sir Humphrey's suggestion, it was employed to some extent for clearing the whites of printed calicoes in the large establishment of Mr. Duffy of Dublin, and with great success, for it was not found to injure in the least even reds and yellows, which had been fixed by mordaunts, while the oxymuriate of lime not only changes all the colours and renders them of a duller hue, but also particles of the lime attach themselves so intimately to the cloth, that it acts as a discharge, and effaces the colours altogether. The oxymuriate of potash again, although not so strong an alternative, changes red to pink, and gives to purple and lilac a bluish shade; the alkali always diminishes the intensity and brilliancy of all colours. The oxymuriate of magnesia seems free from these imperfections.

Sufficient quantities of magnesia can be procured for this purpose from sea-water, or from the residual of liquor of salt works; and perhaps the act which grants a drawback on salt to the makers of chlorine, (38th Geo. III. c. 89, s. 89,) may be found to extend to this use of sea-water; or, if not, a similar act may be procured, to pass when the advantage becomes manifest. It is not unlikely, if the oxymuriate of magnesia shall come into general use, that a similar method will be taken to manufacture it in the dry state, as is now successfully practised with respect to the oxymuriate of lime, in order to facilitate its conveyance to a distance.

ON A COMPOUND OF CARBON AND HYDROGEN, WITH REMARKABLE PROPERTIES.

A paper was read at the Royal Society on the 16th June, by Mr. M. Faraday, containing an account of this curious substance, which he calls a *Bi-carbonet of hydrogen*, from its consisting of two proportions of carbon, and one of hydrogen.

This substance is a fluid deposited in vessels in which oil gas has been compressed. It is colourless, has less specific gravity than water, is almost insoluble in water, but is soluble in alcohol, ether, oils, &c. It burns with a dense flame, and is not acted upon to any extent by solutions of the alkalies. If it is put into gas, burning with a blue flame, it makes the flame bright and white. It dissolves caoutchouc readily, and will answer all the purposes of essential oils as solvents.

Part of this fluid is very volatile, causing the appearance of ebullition at temperatures of 50° or 60°, other parts are more fixed, requiring even 250° or more for ebullition. By repeated distillations, a series of products were obtained from the most to the least volatile, the most abundant being such as occurred from 170° to 200°. On subjecting these, after numerous rectifications, to a low temperature, it was found that some of them concreted into a crystaline mass, and ultimately a substance was obtained from them, principally by pressure at low temperatures, which upon examination proved to be a new compound of carbon and hydrogen. At common temperatures, it appears as a colourless transparent liquid, of specific gravity 0.85 at 60°, having the general colour of oil gas. Below 42°, it is a solid body, forming dendritical transparent crystals, and contracting much during its congelation. At 0° it appears as a white or transparent substance, brittle, pulverulent, and of the hardness nearly of loaf sugar. It evaporates entirely in the air. When raised to 186° it boils, furnishing a vapour which has a specific gravity of 40 nearly, compared to hydrogen as 1. At a higher temperature the vapour is decomposed, depositing carbon.—The substance is combustible, liberating charcoal, if oxygen be not abundantly present. Potassium exerts no action upon it below 186°.

Experimenting with the most volatile portions of the liquid, a product was obtained, which, though gaseous at common temperatures, condensed into a liquid at 0°. This was found to be very constant in composition and properties. It was very combustible. It had a specific gravity of 27 or 28 as a gas; as a liquid, that of 0.627, being the lightest substance, not a gas or vapour, known. When analyzed, it was found to consist of one proportion of carbon 6., and one of hydrogen 1., as is the case with olefiant gas; but these are so combined and condensed, as to occupy only one-half the volume they do in that substance. A volume, therefore, of the gas, contains four proportionals of carbon 24, and four of hydrogen 4 = 28, which is its specific gravity.

Beside the remarkable difference thus established between this substance and olefiant gas, it is also distinguished by the action of chlorine, which forms with it a fluid body, having a sweet taste, and resembling hydro-chloride of carbon; but from which a chloride of carbon cannot be obtained by the further action of chlorine and light.

The other products from the original fluid do not present any characters so definite as the above substances; at the same time they appear to be very constant, boiling uniformly at one temperature.—They cannot be separated by distillation into more and less volatile parts, so as to afford means of reducing their numbers to two or three particular bodies. They have the general properties of the original fluid, and, like the other products, are peculiarly acted upon by sulphuric acid, presenting phenomena, in the investigation of which Mr. Faraday is now engaged.

HEIGHT OF THE PRINCIPAL PARTS OF MOUNT ETNA.

	Feet.
The Summit,	10,874
Foot of the Cone,	9,760
The English House,	9,592
Philosopher's Tower,	9,467
Bishop's Snow Stores,	7,410
Highest part of the Woody Region,	6,279
The Goat's Cavern,	5,362
Angelo, the Herdsman's Cottage,	4,205
Nicolori Convent,	2,449
Lingua-grossa,	1,725
Caltabiana Station,	371
Catania Station,	47

Smyth's Memoir.

REVIEW OF DR. THOMSON ON THE ATOMIC THEORY.

[From the London Journal of Science.]

(Continued from page 222 of the present Volume.)

We shall pass over, without further remark, Dr. Thomson's Historical Introduction, as also his Second Chapter, entitled, "Of the Atomic Theory," as presenting nothing of interest. Having got mystified, to no purpose, among the canons of Dalton and Berzelius, he strives to emerge, by a rank and file parade of acids, with 3 atoms of oxygen, with 1 atom, with 2, 4, 5, 7, and 8; an arrangement turned to no subsequent account.

His Third Chapter, "On the Specific Gravities of Oxygen and Hydrogen Gases," is held forth as "the key-stone of the building," and therefore it merits our especial attention. It is divided into three Sections, the first of which treats of the composition of oxide of zinc; the second, of the specific gravity of oxygen gas; and the third of that of hydrogen gas.

He sublimes ordinary zinc in an earthen retort, dissolves a given weight of it in nitric acid, and then expels the acid, by heating the nitrate to redness in a green glass retort. In this way, he obtains at once, to the minutest fraction, every thing which Dr. Prout's atomic multiples require, *viz.* 5.25 grains of oxide, from 4.25 grains of metal. This felicity of coincidence between his experiments and his theoretical aim is so usual with Dr. Thomson, and with him alone, as to excite no surprise in our minds. Another chemist, in quest of final precision, would have procured his zinc by reviving the metal from a pure carbonate, precipitated from a well crystallized sulphate; as he would know that it is impossible to obtain pure zinc by subliming the metal of commerce. Prout, long ago, sought to determine the composition of oxide of zinc in the above way. He obtained 125 grains of oxide, by igniting the nitrate formed from 100 grains of metal. This made its atomic weight 4; and it is probable that no chemist could get the number 4.25 by oxydizing zinc purified by sublimation alone, as it usually contains arsenic, cadmium, &c., which rise along with it.

We by no means assert that the atomic weight of zinc is not 4.25, for this is the mean number deducible from the experiments of Sir H. Davy, and M. Guy Lussac; and it is a number Dr. Thomson contrives to obtain in another, but very complicated, way. His atomic certainty of results springs out of the following operations. He decomposes a given weight of sulphate of zinc by carbonate of soda, he washes this carbonate on a filtre, dries it, and finally exposes it to a red heat. After these manipulations, Dr. T. gets his experimental weight to tally with his theoretic wishes, to the third decimal figure; a comfort rarely enjoyed by other practical chemists. In the last edition of his *System of Chemistry*, crystallized sulphate of zinc is declared to hold 5 atoms of water; 7 are now recognised, being 2 more than Berzelius and some other inquirers met with. We believe, indeed, that the Doctor's salts have been often in a peculiar state, as to their water of crystallization.

In the section on the specific gravity of oxygen gas, he has the hardihood to refer to his experimental results, published in the sixteenth volume of the *Annals of Philosophy*, as being perfectly accurate, though it has been fully demonstrated that they were wide of the truth.* What renders this reference peculiarly absurd, is, that in the present book he abandons the notions he formerly held, on the weight of moisture existing in a gas standing over water, and adopts a formula for ascertaining its amount, which, though still inexact, yet being applied to his former experiments, throws them all beyond the pale of the atomic theory. To square his experiments with Dr. Prout's numbers, he, on that occasion, estimated the weight of aqueous vapour in his gases, at about one-sixtieth of what they really contained; and now, when he admits that there must be nearly fifty times more moisture in them, still he cites his old results as true. His new ideas relative to aqueous vapour, we shall presently discuss. Meanwhile, let us consider "the attempts which he has made to determine the specific gravity of oxygen gas in quite a different way."

He dissolved in dilute sulphuric acid, 100 grains of distilled zinc, contained in a small glass retort. At the end of twenty-four hours, the metal being dissolved, and the apparatus, &c., having taken the temperature of the room, he obtained in each of two experiments, a volume of moist hydrogen gas, which, reduced by calculation, gave at 60° Fahr., 138.755 cubic inches. He concludes, that one half of this volume, or 69.3775 cubic inches of oxygen gas, have entered into union with the zinc. But from his researches in the preceding section, it appears, "that 100 grains of zinc, when converted into an oxide, combine with 23.5294 grains of oxygen. Hence, the weight of 69.3775 cubic inches of oxygen gas, is 23.5294 grains. Consequently, 100 cubic inches weigh 33.915 grains.* Estimating with Sir George Shuckburgh Evelyn, the weight of 100 cubic inches of dry air to be 30.5 grains, the specific gravity of oxygen comes out 1.1111, or Dr. Prout's theoretic number *exactly*. This concurrence of numbers, in the sequel of such experiments, we may venture to predict, will hardly be realized by any other chemist.

Having settled this point to his entire satisfaction, he concludes the section by a formula, to show what influence the presence of moisture must exercise on the specific gravity of oxygen gas. But his formula is rendered altogether erroneous by his adopting 0.00772, as the specific gravity of aqueous vapour at 60° Fahr. This being a matter of fundamental importance in pneumatic chemistry, and one much misunderstood, we shall devote a paragraph or two to its elucidation.

M. de Saussure took extreme pains to determine, by direct experiment, the weight of aqueous vapour contained in a given portion of moist air. He ascertained that the same volume of different gases, standing over water at a given temperature, afford, on being dried by muriate of lime, the same weight of water; which, for 100 cubic inches of aëriform matter, amounted to 0.35 of a grain. Now the subsequent researches of M. Guy Lussac, and Mr. Dalton, concur to show that the same volume and weight of aqueous vapour exists in moist air, as would be found, at the same temperature, in a vacuum of the same capacity. Thus, 100 cubic inches of moist air, at 60°, will contain 100 cubic inches of aqueous vapour at 60°; which, by Saussure's experiments, weigh 0.35 grains. Dividing this number by 30.5, the weight of 100 cubic inches of dry air, the quotient 0.0114 will be the specific gravity of vapour at 60°, referred to air as unity.

According to M. Guy Lussac, the specific gravity of steam at 212° is to air at 212°, under the barometer pressure of 30 inches, as 0.625 to 1.000. But vapours out of contact of liquids, and air, follow the same rate of expansion or contraction, by change of temperature.

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* See *Quarterly Journal of Science* for June, 1822.

* *Thomson's First Principles*, i. 65. Taking his own data, the above number comes out 69.3765, but this error is of no consequence.

This ratio of 0.625 to 1.000, holds therefore at all temperatures; and we have therefore merely to estimate the diminution of the quantity of vapour, due to its diminished tension. Now from the latest table of elastic forces of steam, that published in the *Philosophical Transactions* for 1818, we learn that the tension at 60° is represented by 0.516 of an inch of mercury; and consequently, that the weight of vapour is diminished in the ratio of 0.516 to 30 inches. But $\frac{0.625 \times 0.516}{30} = 0.01075$; which is the specific gravity of aqueous vapour at 60° Fahr.; and 100 cubic inches of it will weigh $0.327875 = 30.5 \times 0.01075$, or pretty nearly one-third of a grain.

Guy Lussac has also shown that aqueous vapour, at any temperature and pressure, consists of a volume of hydrogen, + half a volume of oxygen, constituting together one volume. Now a volume of hydrogen, thermometer 60°, and barometric pressure 0.516, is $0.001193 = \frac{0.0694 \times 0.516}{30}$; and half a volume of oxygen in the same state is $0.009555 = \frac{0.5555 \times 0.516}{30}$. The sum of these two quotients is 0.01075; precisely as deduced above, in a different manner.

One hundred cubic inches of air, barom. 30, standing over water at 60° Fahr., consist of 100 cubic inches of dry air supporting a barometric pressure of 29.484 inches of mercury, and 100 cubic inches of vapour, sustaining a pressure of 0.516 of an inch of mercury. But 100 cubic inches of dry air, under that pressure, weigh 29.9754 grains, and 100 cubic inches of dry air, under that pressure weigh 0.3278 grains. The sum 30.3032 is the weight of the hundred cubic inches of moist air, sustaining the total pressure of 30 inches of mercury.

In like manner, 100 cubic inches of oxygen gas standing over water, at 60° Fahr., consist of a 100 cubic inches, sustaining a pressure of 29.484 inches of mercury, and 100 cubic inches of aqueous vapour, bearing the remaining portion of the pressure = 0.516 of an inch; 100 cubic inches of such oxygen weigh $33.88 \times 0.9828 = 33.3047 + 0.3278$ vapour. The sum 33.6325 is therefore the weight of 100 cubic inches of oxygen standing over water at 60°, barom. 30. Its specific gravity, compared to moist air, or their relative weights, when taken by the same balloon and balance at the same time, will be $\frac{33.6325}{30.3032} = 1.10986$. But Dr. Thomson's wonder-working balance afforded him *directly*, in these circumstances, the specific gravity 1.1117, being Dr. Prout's theoretic number, where that number ought not to be found. Such a fictitious, or we might rather say, factitious coincidence destroys all confidence in Dr. Thomson's experiments on the specific gravity of the gases.

The above calculation may be represented by the following formula, calling S, the specific gravity of dry gas, (bar. 30, and therm. 60°); v, that of vapour at 60°; f, its elastic force; then the specific gravity of the gas standing over water, bar. and therm. as above, will be $S \times \frac{30 - f,}{30} + v.$

We have seen that a volume of such moist gas consists of a volume of dry gas, supporting $\frac{29.484}{30}$ of the atmospheric pressure + a volume of vapour supporting $\frac{0.516}{30}$ of that pressure. Hence, by deducting from the specific gravity of the moist gases the weight of the volume of vapour present, or its specific gravity, 0.01075, the remainder will be the specific gravity of the dry gases, under a barometric pressure of 29.484 inches. Thus the following tabular view arises. Specific gravity of

	Dry at 30 Barom.	Dry at 29.484 B.		Vapour at 60°		Moist Air at 60°
Air	1.00000	0.98280	+	0.01075	=	0.99355
Chlorine	2.50000	2.457	+	0.01075	=	2.46775
Oxygen	1.11111	1.09199	+	0.01075	=	1.10274
Hydrogen	0.06944	0.06825	+	0.01075	=	0.07900

If moist air be called unity, then the specific gravities of the other gases standing over water will be

Chlorine	2.48370
Oxygen	1.10986
Hydrogen	0.7951

In moist oxygen gas, the aqueous vapour forms only $\frac{1}{102}$ of the total weight; but in moist hydrogen, it constitutes more than $\frac{1}{7}$.

Many readers will probably complain of the prolixity of this developement of the influence of moisture on the specific gravity of the gases. But as Dr. Thomson, and some other chemists of name, have propagated incorrect ideas on the subject, we felt it our duty to rectify them. We shall presently apply these plain enough propositions to the Doctor's new researches, when a comical conflict will be seen, between experiment in masquerade, and a pattern theory. In his anxiety to monopolize the honour of finishing the fabric of Dr. Prout, our author has, unhappily for his fame, deranged the whole edifice, and instead of fixing the key-stone, has actually laboured unwittingly to displace it.

(To be continued.)

AYR MECHANICS' INSTITUTION.

[Established 24th July, 1825.]

On Monday evening, the 4th July, 1825, a meeting was held in the Court-House, for establishing one of those institutions now so prevalent in the kingdom—a Mechanics' Institution in Ayr. The meeting was attended by the magistrates and a number of the respectable inhabitants of the town; by almost all the master-mechanics and heads of manufacturing establishments of the place, and by a considerable portion of the operative-mechanics themselves.

On the motion of Mr. Torrance of Kilsaintninian, and with the universal approbation of the meeting, Mr. Fullarton of Skeldon was called to the chair.

Mr. M'Cormick, having acted as clerk to the preliminary proceedings, gave some account of the source from which the project sprung,—of its cordial reception by all classes of the community—of the steps which had consequently been taken to carry the project into effect—of the preparations which had been made for the meeting—of the manner in which it had been called—and of the purposes for which it had met.

The chairman, Mr. Fullarton, then addressed the meeting in words nearly to the following effect:

"To you, gentlemen, subscribers and friends of the Institution now to be formed, it is surely unnecessary to say much on the advantages of education; but, on this occasion, I feel called on to mention, in as few words as possible, *the object*, and *various views*, and *the ends*, for a Mechanics' Institution in the town of Ayr. The *object*, certainly, ought to be general information, and, more particularly, such studies as are connected with the labours of art. The *views* should be those which contribute to general usefulness and proficiency in the management of knowledge; and the *end* to secure that result from our labours which will, in the largest way, promote the happiness of man, and ensure the comforts of society.

"All are interested in such institutions—the opulent, the luxurious, the old, whether in health enjoying their competency, or under the pressure of infirmity, weakness, and disease; the young, whether born to affluence or to professional labour, as well as the poor workman, whose daily exertions alone must keep himself and family from feeling want. Thus *all* are interested; for, in addition to the blessings of instructions got at our parish schools, the information to be obtained from institutions like that proposed, will greatly aid the artificer and mechanic. And let no one eye this lightly; for on the labour of the mechanic depends, in a very great measure, the progressive humanization of our species.

"The effects of such institutions are strongly and obviously felt in a town in our neighbourhood—a town whose increasing industry, wealth, and consequence, within only a few years past, have been very much owing to the spirited genius of one man. Many present, no doubt, have known the difficulties he encountered, and, perhaps, may know the scanty assistance he had in his successful flight; and that he has succeeded, is now no small blessing to himself and family, and to thousands around him. Although I detest to flatter, it is to me, I must confess, a pleasing though selfish feeling to do justice to merit wherever found, particularly when the object of our praise is not removed from among us; for, with the veneration of sentiment to recal our respect and gratitude for talents and exertions gone, I would wish to enliven those we have, by the *stimulus* which will produce greater exertion while the day is leading to that happiness which humanity so strongly feels—the consciousness of having done our best endeavours, and the enjoyment, by anticipation, of the laurels of posthumous fame.

"The Deity, we know, has given various talents to his creatures, and, as we are accountable beings, the feelings of duty ought to have great influence over us; and it will be fortunate, if, while we are each grateful to Heaven for the gifts we enjoy, we would also recollect a second, but no less imperative, duty which we owe to one another, and to our country. From all these views, what will better promote our purpose of existence here, than extending the means of knowledge, as conducive to our happiness in this world, and more soothingly comfort us, when the curtain is about to drop, and introduce us to scenes and circumstances of a new, unknown, and awful nature?

"The great superiority this country holds in the world is derived not so much by the powers of the mind, as by the early habits acquired at our parochial schools, and, having become by these a people able to read and write, we have, ere we leave the parental fireside, the rudiments of what may forward us in our several pursuits, as philosophers, master mechanics, or operatives, from the lowest departments to the highest scale of mental accomplishment. Surely, therefore, every aid to natural genius, and every means for pushing it forward, ought to be had if possible. This we gain by forming mechanics' institutions; and where the good sense of this reading and thinking country co-operates with the humble efforts of private individuals, they must produce extensively beneficial effects. It is truly gratifying to me, from the frequent communications I have had with tradesmen generally, both masters and operatives, to see such strong good sense, and such dispositions to learn, not only in branches connected with their particular vocations, but to acquire general information. As this propensity is indulged, (which it certainly ought,) the progress of improvement will move with an accelerated step, for it is most fortunate, that, with the disposition, the means now-a-days are more and more afforded for its gratification: and as this disposition prevails, so will useful habits prevail in all mechanics and operatives, producing their own comfort as citizens, and making them steady and useful characters. In bringing the adults to a proper sense of this, the mind is lost in the extent of the happy consequences that may ensue to posterity; for look at the father, or head of a family, and you may, in most cases, judge of the usefulness and habits of his children. We are like precious shrubs and flower-buds in a neglected garden. Unless the kind and generous hand of industry assist and nurture, we must prove sickly, wither, and perish. Notwithstanding the many qualifications that some now and then so luminously show forth, still we are very much the creatures of imitation and education. Let not such principles and motives of conduct, therefore, be lost on us. The subject might lead me into a dissertation in moral and natural philosophy; but though these are happily accessaries to our present scheme, I shall only say that such principles and motives to action should not be lost sight of. The notion that, because a great deal is to be done, or may be effected, nothing need be attempted, is erroneous; as great attainments fall only to the lot of very few. Let us pause before we be influenced by a maxim so stupid and dangerous; for no one can say what the honest exertion of a willing agent can bring forth. It is in efficacy like the widow's mite—the moral feelings of the one giving, in like manner, the proper weight to the contributions of all who propose to aid a general good. Some unfortunate creatures, the slaves of others as miserably weak and ill-informed as themselves, are led to think that no one should keep the lead among men, but those only who are blessed with hereditary rank, or by long tolerated respect for wealth; but these are now decreasing in numbers; and the broad basis of merit, acquired from sobriety, industry, and education, will speedily dispel this flimsy veil, and produce that happy emulation in the world, and that line of conduct best calculated to give free scope to our natural energies—the gift of heaven—and teach all, that the talents they have must be exerted, and not bound up in a napkin.

"How glorious is the march of reason, intelligence, and science, even in vexations under neglect, and degrading thraldom! But every effort we make is, be assured, like the force of each turn of the screw, the knock on the wedge, the weight on the lever, or the condensation of vapour in the steam-engine. Having faculties to understand these things, shall we not promote education? And how can we better do this, under our present circumstances, than by forming and supporting institutions of the sort we are met to establish?

"By forming the Ayr Mechanics' Institution, we but give our mite to the general stock of the ameliorating fund for our fellow-creatures, and bring forth, perhaps, genius that may claim a niche near the busts of a Blair, a Robertson, a Burns, and a Watt. I feel that my ability to do justice to expositions on this occasion, may fall short of the reach I would wish to press them; but, I pray, let not the advocate be considered, but the great and useful cause he wishes to support—the diffusion of knowledge among all ranks of mankind. And may the Almighty give weight to our efforts in doing good, and in the performance of our several duties, and particularly grant success to the Ayr Mechanics' Institution."

The worthy chairman then laid the Resolutions before the meeting for their consideration. They were read by the clerk, unanimously approved of by the meeting, and adopted as the basis of the establishment.

Mr. Ridley of the academy then brought forward the Rules and Regulations for the government of the Institution, which had been carefully prepared, strictly canvassed, and ultimately wholly approved of by the different committees appointed for that purpose. In laying these rules before the meeting, Mr. Ridley observed that, after the very able and eloquent exposition which had just been made by the honourable chairman, in regard to the primary objects which the establishment of mechanics' institutions held in view, it might be deemed altogether superfluous on his part to detain this respectable company with any additional observations. In passing, however, he would beg to impress, in as imperative a manner as he could, on the minds of all present, one fact—that the principal aim of this and of similar establishments, was the dissemination of knowledge, and knowledge of that kind chiefly which could be reduced to the practical purposes of common life. Such an institution as the present was admirably calculated to diffuse the blessings of moral and scientific truth. It would, indeed, be productive of inestimable blessings. It would open up to those connected with it a new source of gratification and delight, and though they might not at first see the full amount of enjoyment which it was certain would arise from it, they might confidently depend that, as they advanced, the prospect would become more and more pleasing and beautiful. No doubt could now be entertained of the efficiency of those enlightened schemes which had been devised by Mr. Brougham and others for the moral and intellectual improvement of the operative classes in this country. The beneficial consequences of such societies were felt by all ranks of the community, and their popularity was abundantly evident from the extraordinary countenance and support their promulgation had received in whatever corner of the united kingdom the experiment had been made. There was a time, however, at no very remote period in the history of our country, when no such scope was afforded for the developement of genius and talent;—a time when a free and unfettered diffusion of information among our humbler brethren was scouted by the rank and influence of the country, as a dangerous instrument of destruction to the well-being of the State, and ought consequently to be wielded by none but priests and despots. This false and hollow doctrine—this bigotted and mistaken policy—has happily vanished from our land, and gone too with the weak and miserable times that gave birth to it. No traces of it—and let us be proud of the change—are now to be found among us. This singular delusion has given place to more generous, more rational, more exalted notions. He bore his testimony to the truth of the aphorism which affirms, that "knowledge is power;" but he would go farther than this, and aver that it is not only power, but it may be accounted the conservator of virtue, and the best promoter of happiness; and that the more a man possesses, the more does he add to the solid enjoyments of his fleeting existence. Mr. Ridley proceeded to observe, that when all other populous districts were vying with each other in promoting the means of instruction among their artizans, he could not but congratulate the meeting on the circumstance, that, in their own enlightened neighbourhood, they had not been the last to come forward and show their zeal in the great and good cause. Their views, ample as they might be, he trusted, would be realized to their most sanguine expectations; but he must be permitted to observe, that much depended on their starting fair; it was here that their weight and influence should be most particularly directed: all depended on a good beginning. If they proceeded with prudence and caution now, and adopted no scheme on mere theory, and devised no plan without a perfect conviction of its practicability, their future labours would unquestionably be rendered easy, pleasant, and effective. On the contrary, if they entered into the business at present without moderation and judgment, their future proceedings would necessarily be cramped by conflicting and opposing difficulties, and their hopes unrealized would remain as monuments of their imprudence and mismanagement. Mr. R. concluded by observing, that the regulations he was about to read had been drawn up by a sub-committee, not for their own use, but solely, or at least more particularly, to meet the views of those for whose behoof the society was established. He begged, therefore, most earnestly, that every individual who entertained notions different from those embodied in the proposed rules, might, in the most unreserved manner, speak his sentiments; his suggestions would be gladly listened to, and immediately adopted, if thought proper or reasonable.

The rules so brought forward were read first together, and then one by one. Almost every rule of importance excited some discussion, in which, we were glad to observe, the mechanics, operatives as well as masters, took a considerable share; and ultimately the rules, as prepared by the Committee, with some few amendments, were cordially and harmoniously sanctioned by the whole meeting. Whilst the regulations of kindred institutions established in places where the local circumstances were somewhat similar to those of Ayr, have judiciously been taken as models in framing the rules to be applied to this Institution, there are various points in which they in some degree differ. These differences have arisen after a mature consideration of the subject, and, of course, are regarded as improvements suggested as well by experience as by the difference of local circumstances.

These proceedings engrossed the attention of the meeting until a late hour, and, between nine and ten at night, Mr. Torrance proposed the appointment of the office-bearers and the committee of management for the ensuing year. In this incipient state of the society, and whilst many who, no doubt, intended to become members of it had not yet declared that intention, it was improper to employ the ballot, prescribed by the articles, in the nomination of this committee. It was necessary, however, that great care should be taken in the selection of the managers for the first year of the Institution, for upon their ability and activity the salvation of it might depend. With that feeling, a list of the proposed committee had been made up, which were then read over and unanimously approved of.

REMARKS ON THE PROGRESS OF STEAM NAVIGATION.

By William Bain, Master in the Royal Navy, and Commander of the City of Edinburgh Steam-Packet.

(Concluded from page 223 of the present Volume.)

Benefit of the High-Pressure Engine.

We have hitherto considered steam navigation as applicable only to commercial intercourse, and the secondary purposes of our naval marine. But America, which long since counted upwards of 300 steam-vessels, classes several of that number among her men-of-war. In the event therefore of going to war with our trans-Atlantic friends, we shall be obliged to meet them with their own weapons, by *squirting hot water*, throwing shot from 100-pounders, and building ships with sides thirteen feet in thickness, composed of alternate layers of oak and cork, fitted with rows of cutlasses and pikes made to project and recede by an impulse from the *high-pressure engines* which propel the vessels. It is to this last particular that we now call the attention of our readers, as one that is calculated to give America a preference over the mother-country, where the use of *low-pressure engines* only is admitted by law. The steam-vessels of the Americans must therefore excel those of the British in proportion to the power and efficiency of the respective engines. Regarding these we may remark, that the limited operation of low-pressure steam arises from the application of the condensing principle, so that the engine seldom works with a greater pressure than eight pounds upon the square inch of the piston. In the high-pressure engine, on the contrary, the steam is not condensed, but is allowed to accumulate its force, which is measured only by the opposing resistance of the work, and the strength of the boiler. Instead, therefore, of eight pounds to the square inch, it is not uncommon to work the high-pressure engine with a force equivalent to 150 pounds; and some say that this may be augmented even to 1000 pounds upon the square inch. By the low-pressure engine, we not only lose power, but the apparatus occupies so much space in the ship, and consumes so much fuel, as to render it very defective for the purposes of navigation. For example, if we take a steam-packet which is to be worked with the power of 100 horses, no less than about forty-four feet of the length and breadth of the vessel is occupied for the engine and its fuel. The consequence is, that in order to afford the necessary accommodation for goods and passengers, the British steam-vessel is built out of all just proportions, her port-charges, of every description, are thereby enhanced, and the difficulty of navigating these large and ill-proportioned vessels, in narrow fare-ways, is greatly increased. On the other hand, with the high-pressure engine, only one half of the space is occupied, and a vessel of 300 tons would do more work, and be every way better fitted for the purpose, than one of 500 tons, while the saving of fuel, and every other item of expense, is proportionably reduced, without lessening the capabilities of the vessel for stowage, while her speed is greatly increased.

The only question in doubt, as to the propriety of substituting the high-pressure for the low-pressure steam, is the danger from the accidents of explosion. With the former the legislature has here very properly interfered, until the safety of the lieges is more securely provided for. But were this properly taken up, and rendered the subject of efficient experiments, we are confident that the ingenuity and foresight of our engineers would overcome all this. It therefore becomes matter of grave consideration, how far it is proper to restrain our Steam Navigators from all use of the high-pressure engine. We are aware that there is no subject on which Parliament enters with more delicacy, than all interference with the laws which regulate trade; and though distressing accidents with the use of high-pressure engines have occurred both in America and Britain, yet its total prohibition is, nevertheless, a measure of very questionable propriety, and one which will in the end be found quite incompatible with any future state of warfare. The American privateers and squadrons will, in the first instance, possess facilities for annoying our coasts with desultory warfare and our trade in foreign seas. The distance between the two countries will then cease to form the barrier which it has hitherto done. From the abundance of wood, in the process of clearing the country, timber has been the chief fuel of America, and the discovery of coal has been little attended to. Their attention has, however, been much directed to the metallurgic art of late, and many inexhaustible seams of coal have been discovered in various parts of that country.

Although we would not question the justness and the humanity of our legislature, in putting a seasonable check to the use of high-pressure steam, yet we doubt the correctness of the advice which led to its entire prohibition. We all know the benefit which Steam Navigation derived, and the confidence it acquired, by the early encouragement of the Post-office department, the experimental vessels which it built, and the early application of steam, for the transfer of the mail across the Irish channel, between Holyhead and Dublin. We farther trust that it is not too much to expect that the Admiralty will, in like manner, institute a train of experiments, applicable to the subject of high-pressure engines, upon a scale, and under a superintendence, which may ultimately render it as safe as the low-pressure engine, now authorized by law.

This subject, we flatter ourselves, will acquire additional importance in the view of every one when we state the expense and contingencies of Steam Navigation, which is, perhaps, known to very few. A steam-packet, of 100 horses' power, equipped to the taste of the present times, will probably cost about £20,000; expenditure of fuel at the rate of one half chaldron of coal per hour, * wages and victualling, per

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* The London duties exacted on this consumption form one of the most grievous and unjust taxes that can be imagined. The London and Edinburgh steam-packets, for instance, during the summer months, burn, on an average, about 120 chaldrons of coal per week; and although 115 chaldrons of which are consumed without the

month, £250; tonnage duty, lights, pilotage, and port charges, £200 per annum; insurance, £100 per month; small repairs and winter expenses, say £500. But this is not all; a steam-vessel is calculated only at ten year's purchase, and, therefore, to renew her, we must lay aside a sinking fund of perhaps £2000 per annum. Besides a set of new boilers in the course of that time, which will cost not less than £1500, being at the rate of £1000 per month, of the sailing expenses of a steam-packet of 100 horse power.

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port of London, yet all the London duties, on half this quantity, are paid for the same as if actually burnt in London.

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QUERIES.

Gentlemen,—Could any of your numerous Correspondents inform me the best method of taking rust off penknives, &c.?

I am, yours, &c.

M.

Laurieston, Nov. 10th, 1825.

Gentlemen,—It is particularly requested by a constant reader of your much esteemed Magazine, if you could inform him from your own knowledge, or any of his brother-readers, the most approved method of painting with china ink on wood, if he requires to give it a coat of isinglass, or gum, previous to laying on the colour, &c. and any other little particular both in common use and otherways. Your insertion of the above at your convenience, will oblige,

Yours, &c.

J. P.

Gentlemen,—I shall feel greatly obliged by your early insertion of the following inquiry in your valuable publication. If in a sour, (made use of by bleachers,) composed of vitriol and water, it be probable that the vitriol, on account of its great specific gravity, will settle to the bottom, and thus injure the texture of the article steeping? Being a person of but limited chemical knowledge, this is a difficulty to me, though it may not be so to some of your friends.

I am yours, &c.

A Reader.

Whitehaven, 11th Nov. 1825.

[Our Correspondent need be under no alarm lest the texture of his goods be injured from the cause he alludes to, for this very simple reason, that "a sour," is neither more nor less than dilute sulphuric acid. The sulphuric acid does not remain suspended in the water, so as that by its greater specific gravity it can settle to the bottom. It mixes with the water, and merely becomes an acid of less specific gravity; that of the sulphuric acid of commerce being, according to Ure, 1.8452; and that of the sour varying, according to Parkes, from 1.0146 to 1.0238.]

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MISCELLANIES.

American Steam Ship.—A letter from New-York thus describes the steam ship Robert Fulton, which is to be employed on the coast of Cuba in the suppression of piracy:—The Robert Fulton is capable of carrying 20 boats; five on her quarters and stern, the remainder on deck; the boats in size equal to a frigates' cutter. She can accommodate 300 or 350 men, and can, with such boats, pursue the pirates into bays, inlets, creeks, &c. With one long gun on a pivot, she can take a position in a calm, and destroy an enemy's vessel of twice her force; with the engine she can go to any point in a time, and despatch her boats into the bays, creeks, &c.; and with her long gun cover them in their operation. The top masts and top-gallant mast can be struck, in which case the ship cannot be seen at sea farther than a vessel of 100 tons. The ship sails fast, works well, and performs under canvass all that a ship of war can do. When the wind is favourable, the steam is not wanted.

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CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

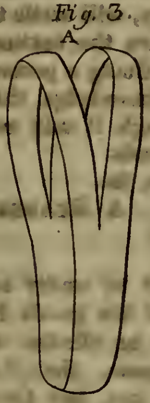
> "All the studies and arts which are necessary in human life, are so interesting and obvious, that man, in every situation, has always, by instinct and common sense, turned his thoughts to them, and made some progress in the cultivation of them."

No. CII. *Saturday*, 3d *December*, 1825. Price 3*d*.

APPLICATION OF BRAMAH'S PRESS; NEW POWER LOOM,

By Mr. G. Whyte; &c.

Fig. 3.



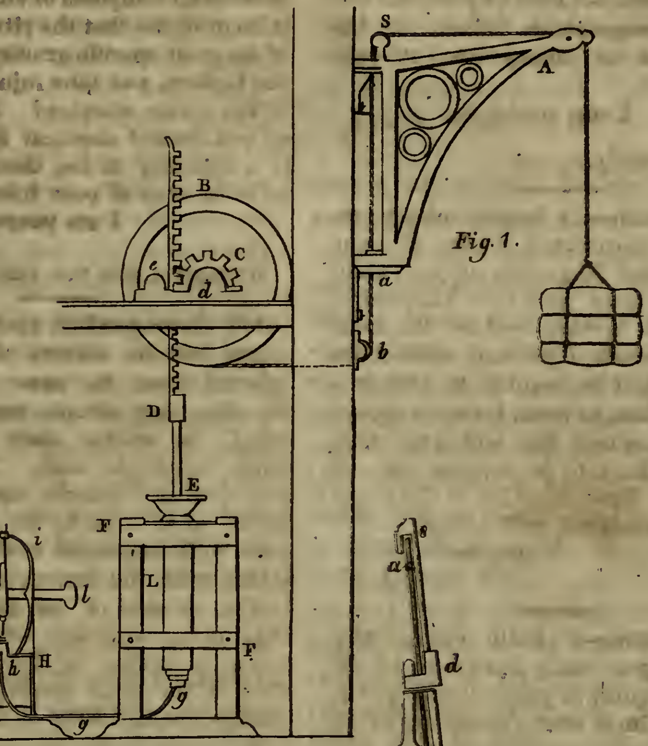


Fig. 1.

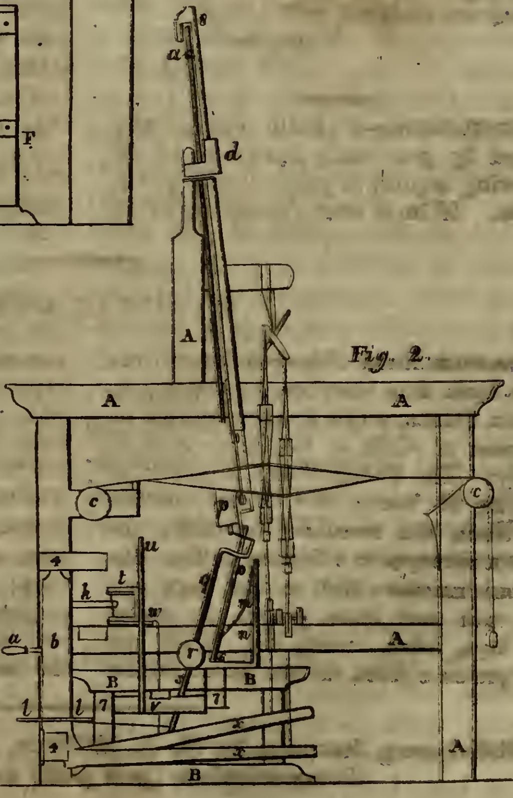
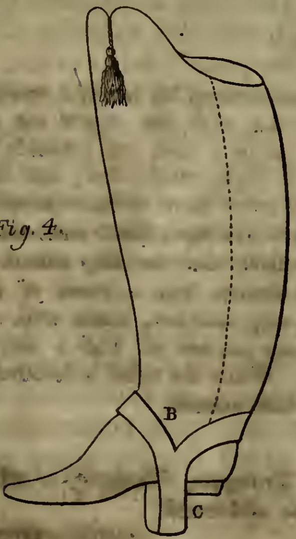


Fig. 2.

—Swan Sc—

Fig. 4.



APPLICATION OF BRAMAH'S PRESS.

MR. BRAMAH's ingenious mechanical principle of gaining a great power by hydrostatic pressure, is applicable in several ways to the raising of heavy weights, and has been frequently employed in powerful cranes. In these the power is not obtained by wheel-work, pullies, or any other of the mechanical powers, but on the principle of the experiment called the hydrostatic paradox, which has been known for ages, though the application of its power to useful purposes is due to Mr. Bramah.

The simplest form is for a machine to raise a heavy weight to a small height. A metallic cylinder, sufficiently strong, and bored cylindrical within, has a solid piston fitted into it, which is made perfectly water-tight, by a leather or other packing, round its edge. In the bottom of the cylinder is inserted the end of a small tube, by means of which, water or any other fluid may be introduced from a forcing pump. This pump is of course provided with valves to prevent the return of the water. If we suppose the diameter of the cylinder to be six inches, and the diameter of the piston of the small pump, or injector, only one quarter of an inch; the proportions between the two surfaces or ends of the pistons will be as the squares of their diameters, which are as 1 to 24; therefore the areas will be as 1 to 576; and supposing the intermediate space between them to be filled with water, or any other dense and incompressible fluid, any force applied to the small piston will operate on the other in the proportion of 1 to 576. Suppose the small piston, or injector, to be forced down, with a weight of 20 cwt. which can easily be done by means of a long lever, the piston of the great cylinder would then be moved up with a force equal to 1 ton multiplied by 576.

The annexed figure represents a crane constructed upon the hydrostatic principle; that is, by the injection of water from a small pump into a large cylinder, which is fitted with a piston, having a rack attached to it for the purpose of turning a pinion upon the axis of a large drum-wheel or barrel, round which the rope is coiled, and from thence passes to the jib.

A, (fig. 1,) represents the jib, made of iron, and supported upon two brackets *a*, *a*, projecting from the wall of the warehouse in which the crane is supposed to be erected. The rope passes over the pulley S, and down through holes in the brackets *a*, *a*, then turns under the pulley *b*, and comes to the lower side of the great drum-wheel B. The pinion C is fixed on the same axis with this, and its gudgeons turn in small iron frames *d*, bolted down to the floor of the warehouse. The pinion C is actuated by the teeth of the rack D, and a small roller, whose pivot is shown at *e*, presses against the back of the rack, to keep its teeth up to the pinion. The rack is attached to the piston D, of the cylinder E, in which the power for working the crane is obtained. The piston passes through a tight collar of leather on the top of the cylinder at E, which does not admit of any leakage by the side of it, and, therefore, if any water is forced into the cylinder, it must protrude the piston from it. The cylinder is supported in a wooden frame F, F, and has a small copper pipe *g*, *g*, proceeding from the lower end of it, communicating with a small forcing pump at *h*; this stands in an iron cistern, H, which contains the water, and sustains the standard *i*, for the centre of the handle G, with which the pump is worked by one or two men. The upper extremity of the standard *i*, guides the piston rod of the pump to confine it to a vertical motion; *l* is a weight to balance the handle, G, of the pump. From what we have said before, the operation of this machine is evident; the power of the cylinder D, is in proportion to its size, compared with the size of the pump; but as it only acts through short limits, the pinion and drum B are necessary to raise the weight a sufficient height. The operation of lowering goods by this crane is extremely simple, as it is only necessary to open a cock at *m*, which suffers the water to escape from the cylinder into the cistern H, and the weight descends, but under the most perfect command of the person who regulates the opening of the cock; for, by diminishing the aperture, he can increase the resistance at pleasure, or stop it altogether.

NEW POWER-LOOM.

By Mr. George Whyte, Glasgow.

[In No. XCVIII. we presented a front view of this ingenious machine, and we intended immediately after to have inserted the present sectional view, with a description of it. The serious illness, however, of a workman in the employment of our engraver, has hitherto prevented this. We now give the sectional view and part of the description, the remainder of the description we shall insert next week.]

The improvement of the arts and manufactures is a subject of great importance to a commercial country; and to a city like this, so much engaged in the manufacturing of fine muslins, improvements of that kind are of particular importance. Any improvement which might enable the manufacturer to make his goods at a cheaper rate, is certainly beneficial to the country. Such is the design of the machine I now offer to the public—a machine which I have invented, original in its principle and construction, for the weaving of fine muslins by power. It is particularly applicable to the weaving of all fine and light fabrics, such as lawns, jaconets, fine cambrics, and silks, *viz.* bandanas, persians, sarcenets, &c. The machine can be easily applied to all kinds of tweeling. From the manner in which the power acts, the movements are smooth, and have a striking resemblance in their effect to the movements of the hand-loom. They are capable of exact regulation and adjustment. All the movements are combined in one common centre, which I may call the concentrator. It is marked *b*, in fig. 2, of the present No. and in the plate of No. XCVIII. The concentrator is a beam, which has three levers and the handle screwed on the squares. The two levers on the lower end of the beam of the concentrator are marked *l*, *l*, the other lever on the inside, at the top, represented in fig. 2, is marked *k*, and the handle is marked *a*. The movements immediately connected to the concentrator are three: the movement of the cloth beam; the movement of the lay; and the movement of the shuttle. The forming of the shed is immediately connected with this movement. The movement of the cloth beam is effected by two wheels, two pinions, and a wratchet wheel. These are connected to the lever, *k*, (fig.

2,) of the concentrator, by a journal, marked *k*, in No. XCVIII. The lay is driven to the fell by a spring, *m*, of a particular construction, represented in figure 2. It is drawn from the fell by the lever, *q*, of the represser, *r*, represented in the same fig. The represser consists of a beam moving on its centre, and three levers. Two levers, *s*, *s*, fig. 2, are screwed on each end of the beam. The other lever, *q*, connected to the sole of the lay, is screwed on the upper side exactly in the middle of the beam. The under levers, *s*, *s*, of the represser, are connected to the levers, *l*, *l*, of the concentrator. The shuttle is driven by two springs, one on each end of the rocking-tree. These springs are of the same form as that of the lay. From their construction they act alike at all points. It does not require more power to carry the movement to its greatest stretch, than what it does at the commencement of the movement; because the little movement the springs have tends to the centre of the players. The players move on pulleys; hence they have little friction, consequently the movements are smooth, and the springs are liable to little breakage. The repressers, *c*, *c*, *c*, *c*, (fig. 1, No. XCVIII.) of the shuttle shaft, or wiper, conveys motion from the main shaft, *u*, represented in fig. 2, which is connected to the lever, *k*, of the concentrator. The treadle cords passing under two pulleys at *h*, (fig. 1, Number XCVIII.) beneath the treadles, and passing over two pulleys, placed on each side of the beam, *w*, for the regulation of the size of the shed, are fastened to the main shaft at *v*. The movements are connected by cords. The figures mark the centres of the moveable parts.

CHEAP, INFALLIBLE, AND PORTABLE BOOT-JACK.

Fig. 3 consists of a piece of tough leather, about eighteen inches long, and an inch and a half wide, the ends of which are to be firmly sewn together with wax end, having an incision cut as represented at *a*, the opening of which must be sufficiently large to admit of the foot of the boot to be pulled off, passing through, as shown at *b*, in fig. 4, one part resting on the instep, the other on the heel; the toe of the other foot is then to be thrust into the vacancy at *c*, when, by a little exertion, the tightest boot may be drawn from the leg with the greatest certainty. A boot-jack of this description is cheap, because it cannot cost more than one shilling; portable, because it can easily be carried in the coat pocket, or rolled up into a very small compass; and infallible, because it has an equal purchase on the instep and heel, without the possibility of the boot slipping out.

ACCOUNT OF AN ORRERY IN THE FIFTEENTH CENTURY.

The following description of a planetarium, constructed at Florence in the fifteenth century, by Angelo Politiano, at the time when the arts flourished under the liberal patronage of Lorenzo de Medici, is interesting, as exhibiting the progress made in science in former times. The description of a complex piece of machinery, must, without the illustration of engravings or drawings, be obscure, but the parts of the description will be intelligible to such as are acquainted with mechanics. It is only necessary to say, that the machine in question was intended as an illustration of the Ptolemaic system, which was the orthodox creed of philosophy at the period of its construction.

Politiano's account of the machine may be thus translated:—"The machine consists of a pillar of a pyramidal form, about three cubits in height, surmounted by a flat circle of brass, ornamented with gilding and colours, on one part of which, (being less than a cubit in diameter,) the course of the planets are described. This circle of brass is moved by tooth wheels, which act within it, and its edge plays within an immoveable circle, which is graduated into four-and-twenty divisions, corresponding with the four-and-twenty hours of the day. On the extremity of the moveable circle are engraven, at equal distances, the twelve signs of the zodiac. In the inner part of this circle are seen eight small circles, or wheels, of nearly equal magnitude. Two of these are in the centre, and are connected with each other in such a manner, that the lower, which is the larger of the two, represents the sun, and the higher the moon. An index, extending from the sun to the outer and immoveable circle, points to the hour of the day; and on the circle where the signs of the zodiac are delineated, it notes the month, the day, the number of degrees, and the true and mean motion of the sun.

"A style also extends from the moon, designed to act as an index of her time, which is marked below on the edge of the greater of the small circles, or wheels. This style passing through the centre of the lunar epicycle,* and reaching the delineation of the zodiacal signs, denotes the moon's mean motion. Another style, projecting from the same spindle as the former, and cutting the centre of the moon's body, that is, the epicycle points out her true place. By this apparatus, the acceleration and retardation of her motion, the whole of her course, her conjunction with the sun, and the phenomena of full moon, are clearly and distinctly seen. Around these are six small circles, or wheels, one of which, called the dragon's head and tail, indicates the eclipses both of the sun and moon. The remainder represent the planets, from each of which project two indexes, intended to point out their motions, just like those which I have mentioned as being attached to the moon. But these also move in a retrograde course, which is not the case with the moon. By these means are denoted the conjunction, the retrocession, and the latitude of each planet. There is likewise another circle like that on which the signs of the zodiac are marked, which passes over the six planets. This denotes the degrees of the signs, and the length of the day, that is, the time of the sun's rising. The small circles, or wheels, indicate the motion of each planet, which, with alternate change, move in the day time from west to east, and in the night from east to west. But, on the contrary, the largest moveable circle, in the space of twenty-four hours moves the planets in the night from west to east, and in the day from east to west. Reason evinces, and the most able philosophers are agreed, that these circumstances exactly agree with the phenomena of the heavenly bodies.

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* Epicycle, in the ancient astronomy, was a little circle whose centre was in the circumference of a greater circle. It was conceived to be a small orb or sphere, which, being fixed to the great circle, formed by the revolution of a planet, was carried along with it, and, at the same time, caused the planet to revolve round its own centre.

"It is not wonderful that people should deem the description of this machine an incredible fiction, for, as some one has observed, 'Credit is slowly given to important discoveries.' We ourselves can scarcely believe our eyes, though we see the thing every day.—When I some time ago read an account of some such apparatus being invented by Archimedes, the Syracusan, I could hardly believe the story, which our countryman has now rendered perfectly credible. The work is above all commendation, nor can it be otherwise adequately praised, than by confessing that no praise can equal its merits. It is a matter of doubt, whether the artist is more to be admired on account of the probity and sanctity of his life, or on account of his ingenuity. So much are we persuaded of this, that we are inclined to think that he was sent down from the sky, and that in heaven itself he learned the construction of the heavens!"

Q. Q.

ON THE CAUSES OF THE VARIETY OF COMPLEXION AND FIGURE IN THE HUMAN SPECIES.

Whether all the varieties of complexion and figure can be traced to the effects of climate and the state of society, or whether there have existed from the beginning different species of the human race, characterised by a peculiar complexion and figure, are questions which have been strenuously supported, and as keenly opposed.—The former of these positions seems entitled to credit, being strengthened equally by reason and fact.

The ancients, acquainted with few black nations, ascribed the colour of their skin to the perpetual action of the rays of the sun. The shades of colour they observed gradually deepening as they approached the equator, and, on the contrary, the complexion becoming more and more fair as they retired northwards; and hence they ascribed this diversity to the effects of climate.

Modern discoveries, however, have taught us many exceptions to this rule, ascertaining that nations of different complexions are to be found under the same parallel, and hence the opinion that different regions of the earth have been peopled with different races of men. The degree of heat pointed out by the thermometer, not the degree of latitude, would furnish, indeed, a more accurate rule, subject, however, to modifications. Now, the best must vary very considerably, according to the elevation of any country above the level of the sea, the heights of its mountains, and the extent and nature of its surface.

When we find no blacks in America under the torrid zone, we have only to reflect upon its immense extent of ocean, numerous lakes, and lofty mountains eternally covered with snow, cooling the scorching breezes of the torrid zone, and converting it into a more temperate climate. Would not the discovery of negroes, then, in America, prove the existence of different races, by proving that the colour could not be ascribed to the effects of heat?

It has been objected, that in Africa, on one side of the river Senegal, the inhabitants are perfectly black, and on the other side, only tawny; but may we not account for this by supposing the effects of climate counteracted by the quality of their food, and many other circumstances. Our ignorance, indeed, of all these tribes, should make us very cautious in drawing conclusions from facts not well ascertained. "The flesh of hares in plains and moist grounds," says Buffon, "is whiter than that of those in mountainous or dry regions." The qualities of the food necessarily affect the qualities of the blood, and this again the colour of the flesh.

Besides, a tribe emigrating from a temperate to a hot climate, will not acquire, perhaps for ages, that shade characteristic of the indigenous inhabitants.

We may, therefore, sometimes find contiguous tribes of very different complexion. This may be heightened too, by the numerous causes which keep them aloof from each other. An intimate knowledge, therefore, of the antiquity or recency of the emigration of such tribes, of their friendships, hostilities, &c. is requisite, before any legitimate conclusion can be drawn, at all affecting the present discussion.

In Cochin China are found two descriptions of Jews, the one completely black with a Hindoo complexion, and the other white, owing doubtless to the recency of their establishment. The Portuguese settled at Metomba in Sierra Leone, have, by their marriages with the natives, and by the operation of the climate, been changed into perfect negroes, with wooly hair, thick lips, &c. and only prove their European origin by retaining a smattering of the Portuguese language.

On the other hand, the negroes of the United States, though intermarrying with each other, are gradually losing the curled hair and black complexion of their African progenitors. This view of the subject accounts for the varying complexion of the Jews in various parts of the globe. In Britain and Germany they are found fair; brown in Spain and Portugal; copper-coloured in Arabia and Egypt; and almost wholly black in Abyssinia and at Cochin in India.

Dr. Smith of New Jersey, refers the immediate cause of the black colour, 1st, To the degree of heat in the atmosphere. 2d, To the quantity of bile in the skin. The bile when secreted, is peculiarly liable to become mucous, and, in this state, being unfit for perspiration, and attaching itself strongly to a spongy tissue of nerves, it is there detained for a length of time, till it receives the repeated action of the sun and atmosphere.

According to Buffon, both the blood and bile of negroes are blacker than those of other persons, and hence the blackness of the skin. To what, then, is this blackness owing? is it or is it not to the agency of the sun?

Dr. Franklin discovered the fact, which Leslie has investigated very minutely, that *black transmits heat more readily than any other colour*. Hence we may conclude that the negro is, in consequence of his complexion, admirably adapted for the torrid region which he inhabits. With regard to the colour of the hair, we generally find it following the same law as the complexion, for its roots being planted in the skin, derive from it their nourishment and colour. Every gradation of colour in the skin, from the brown to the perfectly black, is accompanied with corresponding shades in the hair. The pale, red, or sandy complexion, on the other hand, is usually attended with redness of the hair, while white hair is found only with the fairest skins.

Climate possesses great influence not only on the hair of men, but also of all animals. The beaver, removed to warm latitudes, exchanges its fur, and the sheep its wool for a coarse hair that preserves the animal in a more moderate temperature. The coarse and black hair of the bear is converted, in the arctic regions, to the finest and whitest fur. The horse, deer, and almost every animal protected by hair, doubles his coat in the beginning of winter, and sheds it in the spring, when it is no longer useful. Climate, too, often changes the colour of the hair. Thus, hares, squirrels, and weasels, are white in northern latitudes, but brown or grey in mild climates. Nay, they sometimes vary their colour in the same country: hares in Sweden are grey in summer, and in winter perfectly white. The bear is white under the arctic circle, and in high northern latitudes black foxes are most commonly found. In the human race, the same effects may be observed. The hair of the Danes is more generally red; that of the English fair or brown; and of the French black. In the elevated regions of the Alps, red hair is found; and at the bottom, black, as the predominant colour.

Q. Q.

(*To be continued.*)

IMPROVED INK-STAND.

In No. XV. of the Scientific Gazette, p. 210, *et sequent*, I notice an allusion to a patent granted for an ink-stand by which the ink is made to flow out by a screw pressure. Altogether the description is clouded and obscure, and the invention appears complicated. Allow me to advert to a very simple method by which a portable ink-stand might be constructed, and which would supply ink when required, re-absorbing that ink when not wanted. A small cylindrical vessel contains a sponge saturated with ink; the outlet is in the manner of the cistern in a bird's fountain; a small cylindrical sliding rod passes through an air-tight lid at top. The end of this rod has a plate which rests on the sponge, and the rod recoils by means of a spring composed of spiral rings attached to it, and thus taking off the pressure from the sponge, suffers it to re-absorb the ink; a small button weight put on the summit of the sliding-rod above, in the manner of Sykes' hydrometer, will compress the sponge and cause the ink to flow. The principle is almost the same, but that now suggested is especially recommended by its simplicity.

I am, yours, &c.

J. M.

26th Nov. 1826.

LARGEST MASS OF EUROPEAN METEORIC IRON.

Colonel Gibbs, in the first volume of Bruce's American Mineralogical Journal, mentions, that, in the year 1805, during a mineralogical tour through the Ardennes, he found, near Bitburg, a mass of iron about 3400 lb. weight, which, he was told, formerly lay on the top of a neighbouring hill, but had been rolled down to its present place. He found it nearly pure iron, with a small proportion of nickel, and considered it as of meteoric origin. In 1817, M. Semonis, a mine-officer, examined the mass, and reported that it was artificial. Chladni, in 1819, arranged it with his problematical meteoric irons. In 1821, Chladni published an extract from Colonel Gibb's account in Gilbert's Annalen, which excited much attention. Nogerrath ascertained that the mass had been disposed of at a small price to an iron-master, who had it removed, after great labour and considerable expense, to his iron-forge. The whole mass was melted and then placed under the hammer, when, to his disappointment, it separated into small pieces, which could not be welded together. It being considered useless, the whole was thrown into a ditch, and covered up. Nogerrath, after considerable trouble, succeeded in obtaining correct information as to the spot where the masses were buried, and dug up many of them, of which he sent specimens to different public collections in Germany. He analysed it, and found that it contained nickel and sulphur, but neither carbon, chrome, nor manganese. To vindicate the claim of this specimen to the title of the largest mass of meteoric iron hitherto found in Europe, it may be remarked that the Pallas iron which fell in Russia weighed 1400 lb.; that of Hradschina only 71 Vienna lb.; the mass called the Cursed Burgraf of Elbogen in Bohemia, 191 lb.; and that which was found at Lenarto in Hungary, 194 lb. In the new world, it is true, masses much larger have been met with, weighing 14,000, 30,000, and even 40,000 lb.

TRANENT MECHANICS' INSTITUTION.

Our readers will no doubt be pleased to learn, that in the village of Tranent, containing but a small number of inhabitants, the spirit of improvement, and the desire for knowledge, has found its way. In May, 1825, a class was opened for instruction in Arithmetic and Practical Geometry, the fee to which was 2/6. per quarter. The fees collected, with a few subscriptions, amounted to £4, with which about 30 volumes of moral and scientific books were purchased, in order to found a small library. The books are lent out to those attending the class; and persons not attending it, are entitled to the use of the library on paying a fee of 2s. per annum. The class was conducted by a Mr. Cunningham, a Student of Divinity, and Teacher in Steel's Hospital, Tranent, who gave his labour gratis: he has, however, from the increase of his other avocations, been unable to continue it; yet it is hoped, we believe, that in the course of the ensuing summer, he will be enabled to resume the class. The library, however, is in the mean time going on with considerable spirit; and the books are read and returned with great regularity and attention. Mr. Cunninghame, in whose exertions the whole may be said to have originated, applied to the Heritors of the Parish, but they refused to lend any assistance. Mr. Brougham's pamphlet, which first suggested the idea, was circulated in the neighbourhood, but without producing any benefit; few or none who are able seem inclined to afford any aid. We should be glad to learn, that those who take an interest in such efforts in other places, have taken into their consideration this struggle for learning which is made by the villagers of Tranent, and have shamed the Heritors of the Parish by affording a little of the assistance which they refused. The members of this Institution have, at present, neither reading-room nor school-room.

ON THE MAGNETISM DEVELOPED DURING ROTATION.

By Mr. Babbage and Mr. Herschel.

In No. LXXXIII. we shortly noticed the experiments made in France by M. Arago, on the effect of copper in motion or at rest, on magnetic needles. Mr. Babbage and Mr. Herschel have pursued the subject with much success, and have communicated an account of their experiments to the Royal Society. In order to reverse the experiment, they put in rotation a powerful horse shoe magnet, and suspended over it various metals and other substances. In this way they developed signs of magnetism in copper, zinc, silver, tin, lead, antimony, mercury, gold, bismuth, and carbon, in that metalloidal state in which it is precipitated from carburetted hydrogen gas works. In sulphuric acid, rosin, glass, and other non-conductors, or imperfect conductors of electricity, no positive evidence of magnetism was obtained.

In order to determine the comparative intensities of these bodies, Messrs. Babbage and Herschel used two methods: 1st, By observing the deviation produced in the needle by plates of great size cast to one pattern; and, 2dly, By observing the times of rotation of a neutralized system of magnets suspended over them. These two methods assigned the same order to all the bodies but copper and zinc; and it is a very curious fact, which the authors have no doubt thoroughly investigated, that the two methods *gave opposite results in the cases of zinc and copper, placing them constantly above and below each other, according to the mode of observation employed.*

Messrs. Babbage and Herschel next investigated the effect of solution of continuity on the various metals, and they ascertained the curious fact, that the re-establishment of the metallic contact in other metals, restores the force either wholly or in a great measure, even when the metal used for soldering has in itself but a weak magnetic power. Hence is obtained a power of magnifying weak degrees of magnetism. They found also that the force varied inversely between the square and the cube of the distance.

From these valuable experiments, Messrs. Babbage and Herschel conclude, that the phenomena may all be explained, by supposing time to be requisite, both for the developement and the loss of magnetism, and that different metals differ, in respect not only of the time they require, but of the intensity of the force ultimately producible in them.—See *Quar. Jour.* vol. xxxviii. p. 276.

DUNBAR MECHANICS' INSTITUTION.

This Institution still advances with spirit and success. Mr. Morton continues to lecture every Wednesday evening to a very crowded audience. He has besides at present a class of 30 young men, whom he is insructing on the evening of every Monday and Thursday in the Elements of Euclid and in Algebra. The plan of self-instruction has here been put into full and vigorous operation. Many young men having expressed their regret that they did not commence with Mr. Morton's classes for Geometry, Mr. William Balsellie kindly undertook to instruct them in Euclid until they should be qualified to join with and accompany the pupils of Mr. Morton in their regular progress. This class consists at present of 10, and meets every Friday evening. Mr. Balsellie is a journeyman mason; he studied himself at the Edinburgh School of Arts; and is mentioned in the 2d report of that Institution, as having most honourably distinguished himself there. Messrs. William and Thomas Galbraith, journeymen masons, have commenced instructing, on the Tuesduy evenings, a class, of 10 or 12 individuals, in Arithmetic; and on Saturday evenings, a Geography class, consisting of 15 or 20 individuals, is conducted by Mr. William Robertson, the Secretary to the Institution, with the assistance of Mr. Andrew Denham, a young writer. We certainly have not heard of any Institution where there is the same proportion of Mathematical Students, and we cannot doubt of this circumstance leading to a beneficial result.

ON THE STEAM ENGINES IN CORNWALL.

We have lately been favoured with a recent monthly report, of Messrs. Leans, on the quantity of work performed by fifty-three engines in lifting water, with each bushel of coals; from which it appears that an engine of Mr. Webb's construction, at the Barton Mine, lifted 43,270,713 pounds of water, one foot high; the load being 18,914 pounds per each square inch in the cylinder. We also find that one of Mr. Woolfe's construction, at the Wheat Alfred Mine, lifted 41,058,808 pounds, one foot high, with a load of 71,658 pounds per inch; and several others, lifting between 30,000,000 and 40,000,000 of pounds, at various loads per inch. There are also reported, twelve steam-engines employed in drawing ores, and four in stamping ores, thus making a total of sixty-nine reported steam-engines employed in the Cornish mines. It should, however, be remarked, that these reported steam-engines are by no means the total numbers of steam-engines employed in Cornwall; and there are, besides, many water-wheels of large diameter, employed in pumping, &c. as well as *pressure-engines*, working by the power of columns of water, employed as steam is in the steam-engines. We are just now informed of a water-wheel erecting at the Wheal Harmony Mine, of fifty feet in diameter, and which is intended to assist in working the pumps employed in freeing that valuable mine from water.—*Journal of Arts.*

TABLE OF THE HEIGHT OF THE EUROPEAN MOUNTAINS.

(From the History of Monte Rosa, by Baron Welden.)

FIRST CLASS.

	Paris feet.
Mont Blanc,	14,764
Monte Rosa, 1st, or highest Peak,	14,222
2d Peak,	14,154
Monte Rosa, 3d Peak,	14,028
4th Peak,	12,984
5th Peak,	13,650
6th Peak,	12,984

SECOND CLASS.

	Paris feet.
Mont Cervin, *Saussure*,	13,854
Finster Aarhorn, *Tralles*,	13,234
Le Geant,	13,044

THIRD CLASS.

Mountain between the valley of Matter and Saas,	12,882
Jungfrau, *Tralles*,	12,872
Mönch,	12,666
The Great Peloux, W. of Briançon,	12,612
Shreckhorn, *Tralles*,	12,560
Iseran in Savoy,	12,456
Eigner, *Tralles*,	12,368
Mountain N. W. of Briançon,	12,138
Point Oerteles, Tyrol,	12,059
Aiguille du Midi,	12,054
Breithorn, *Saussure*,	12,012
Glockner in Salzburg, *Schiegg*,	11,988
Monte Viso, *M. Plana*,	11,808

FOURTH CLASS.

	Paris feet.
Zebru Konigs-Spitze, near Oerteles,	11,516
Wetterhorn, *Tralles*,	11,453
Altes,	11,432
Aiguille D'Argentiere, *Raymond*,	11,412
Frau, *Tralles*,	11,393
Dent Parassée, Savoy,	11,388
Gallenstock,	11,330
Monte delle Disgrazie,	11,316
Weissbachhorn, Salzbourg,	11,300
Doldenhorn, *Tralles*,	11,287
Monte Tresero,	11,136
Roche St. Michael, the highest point of Mont Cenis,	11,058
Dœdi,	11,839
La Rame in Savoy,	10,968
Monte Adamello, Tyrol,	10,950
Sustenhorn,	10,910
Roche Melon, S. E. of Mont Cenis,	10,878
Titlis, *Saussure*,	10,818
Aiguille d'Arve, Savoy,	10,776
La Pelouse, Savoy,	10,775
Mont Perdu, Pyrenees,	10,518
Monte Confinale, near Oerteles,	10,392
Glacier d'Ambin,	10,380
Vigne Male,	10,374
Moschelhorn,	10,280
Mount Etna, *Shuckburgh*,	10,254
Pizzo Scalino,	10,248
Liconcio,	10,221
Poz Valrhein,	10,220
Glacier de Chardon,	10,200

REVIEW OF DR. THOMSON ON THE ATOMIC THEORY.

[From the London Journal of Science.]

(Continued from page 238 of the present Volume.)

In order to ascertain the weight of a given volume of hydrogen gas, he dissolved a certain weight of zinc in dilute sulphuric acid, contained in a matrass, to whose orifice there was luted a glass tube, filled with dry muriate of lime. The quantity of his zinc "was unluckily very much limited by the small size of the flask," whence the temperature of the mixture was less uniform, and the heat of the effluent moist gas proportionately uncertain; for in one experiment, it rose from 50° to 87°, and in another from 48° to 81°, when the flask stood in the air. In subsequent experiments, therefore, he surrounded the flask with water at 48°, but as he did not insert the bulb of a thermometer into the matrass, the temperature of its interior was unknown, and consequently that of the gas disengaged.

On repeating Dr. Thomson's experiment, we have found that the interior thermometer stood very considerably above that of the exterior one, whose bulb was near the vessel, or even in contact with it; and that, probably, the temperature of the effluent gas may be estimated at about 11° or 12° above that of the water-bath surrounding the flask.

When 100 grains of zinc were dissolved, "the loss of weight sustained by the flask was 3 grains, and the tube containing the muriate of lime had increased in weight 0.163 of a grain." * From former experiments, he found that 100 grains of zinc afforded, during their solution in dilute acid, 136.88 cubic inches of hydrogen gas, bar. 30.1, therm. 49°. "The specific gravity of vapour at 49°, under a pressure of 30.1 inches of mercury, is 0.00533; and the weight of the vapour, contained in 136.88 cubic inches of moist gas, is 0.0533 × 136.88 × 0.305 gr. = 0.2225 grain; but the moisture retained by the muriate of lime was only 0.163 grain.

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* Thomson's Attempt, i. 69.

It is obvious from this, that the hydrogen still retained 0.059 of a grain."

"If from the weight lost, amounting to 3 grains, we substract this 0.059 grain for moisture, the remainder, amounting to 2.941 grains, gives the true weight of the hydrogen gas exhaled, supposing it perfectly dry. Now, from the experiments related in the last section, we know that the volume of this gas, under the pressure of 30 inches of mercury, and at the temperature of 60°, is 138.7551 cubic inches."[*]

There is an astounding fatuity in this passage. The flask loses 3 grains in weight; of this loss he calculates that 0.2225 is due to moisture vaporized in the hydrogen. Hence, 3 — 0.2225 = 2.7775 is the weight of the dry hydrogen, by his own showing. The fractional quantity 0.059 is merely the moisture, which, by his account, escaped the hygrometric action of the muriate of lime, which quantity + that in the muriate of lime = 0.2225 falls to be deducted from the loss of weight in the flask = 3 grains.

And what is the drift of this *novel* experiment? Do its results show the *weight* of a given bulk of hydrogen, in a definite state of moisture or dryness? Certainly not. For, though his purpose was to determine *experimentally* the proportion of dry air and moisture in a known volume of the moist gas, he is obliged to have recourse to calculation to learn that proportion. But as he does not know the temperature of the effluent hydrogen, he wants the essential *datum* of that calculation. And supposing that by a wiser disposition of the experiment, he had known this *datum*, still his result would have been wrong, because the specific gravity of aqueous vapour is very different from what he assumes it to be in his formula. The confusion of thought, discovered by the Doctor on the present occasion, can only be accounted for on the supposition, that his head got turned in planting, as he fondly fancied, "the key-stone" of the grand atomic arch. We do not consider the experiment susceptible of remarkable precision in the best hands; but at any rate it might be made a *rational*, if it cannot be made a delicate one, by causing the disengaged gas to traverse a convoluted glass tube, surrounded by melting ice. The hydrogen would then escape in a definite hygrometric state, and its weight would be exactly known from the loss of weight suffered by the apparatus.

He concludes as follows:—"Thus it appears that 138.7551 cubic inches of dry hydrogen gas (bar. 30 inches, therm. 60°) weigh 2.941 grains; consequently 100 cubic inches must weigh 2.119 grains."

On the contrary, the weight of that bulk of his dry hydrogen is, by his own statement, 2.778 grains, and therefore the weight of 100 cubic inches is 2.778 divided by 1.387551 = 2.002.

"But we have seen in the last section that 100 cubic inches of oxygen gas weigh 33.915 grains; now

2.119 : 33.915 : : 1 : 16.005.

"This approaches so nearly the ratio of 1 : 16, that it leaves no doubt that the specific gravity of oxygen gas is exactly 16 times greater than that of hydrogen gas."[*]

It is truly fatiguing to wade through such an inundation of blunders. His own result, in reality, gives 2.002 grains for the weight of 100 cubic inches of dry hydrogen (bar. 30, therm. 60°), whence the following proportion:—2.002 : 33.915 : 1 : 16.9, a number which, if true, would utterly subvert Dr. Prout's theory.

But it is time to return to his estimate of the specific gravity of vapour at 49° bar. 30.1. He states it, most erroneously, at 0.00533. Let us take (as he does) Mr. Dalton's number, 0.363, for the elastic force of aqueous vapour at 49° Fahr. Now, the true specific gravity of such vapour, according to the principles so clearly established above, is $0.0075625 = \frac{0.625 \times 0.363}{30}$, air at 49° = 1.000000. But in reference to air at 60° = 1, the number becomes 0.00773; for the density of air at 49° is to that 60°, as 508 : 497; whence we have this proportion:

497 : 508 : : 0.0075625 : 0.00773.

Hence the weight of moisture in his 136.88 cubic inches (or 3 grains) of hydrogen gas, is 0.00773 × 136.88 × 0.305 grains = 0.3227. But the muriate of lime intercepted (he says) 0.163 grains; therefore 0.3227 — 0.163 = 0.1597 of a grain must have remained in the hydrogen, assuming his experiment to have been accurately made. Thus we see that about one-half of the moisture escaped the action of the calcareous muriate, so that its presence merely complicated the result. Deducting from 3 grains, which is the whole weight of humid hydrogen disengaged from the flask, the 0.3227 of a grain of aqueous vapour, we have a remainder of 2.6773 grains, for the weight of dry hydrogen, whose bulk, he says, would have been at 60° Fahr., 138.7551 cubic inches. Hence $\frac{2.6773}{1.387551} = 1.9295$. This, therefore, is the weight of 100 cubic inches of dry hydrogen, by Dr. Thomson's *experiments* at 30 bar. and 60° therm. And 1.9295 : 33.915 : : 1 : 17.57. "This approaches (*not*) so nearly the ratio of 1 : 16, as to leave no doubt that the specific gravity of oxygen gas is *exactly* 16 times greater than that of hydrogen gas." Consequently, the specific gravity of hydrogen gas is $\frac{1.1111}{17.57} = 0.0632$; a very different result indeed "from the specific gravity already deduced by Dr. Prout (0.0694), and which I obtained experimentally, as may be seen in my paper on the specific gravity of gases."*

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[*] Thomson's Attempt, i. 70.

[*] Thomson's Attempt, i. 71.

Of the result to which he here refers, and which is given in the 16th volume of his *Annals*, p. 168, it is sufficient to say, that he found the specific gravity of moist hydrogen, compared to that of moist air, to be by experiment as 0.0694 to 1.000,† though Dr. Prout's theory, whose truth he was labouring (most unskillfully, it must be owned) to demonstrate, requires the experimental specific gravity of moist hydrogen to be to that of moist air, as 0.07951 to 1.00000, a proportion very wide indeed of Dr. Thomson's result. For, if hydrogen gas, standing over water, be *not* to air standing over water, both at 60°, as 0.07951 to 1.0000, then dry hydrogen gas will *not* be to dry air as 0.0694 to 1.0000.

We are really ashamed of the necessity for such multiform details, but the Doctor so unblushingly foists on the public his old battered brass as genuine current coin, that we were here forced to call the tilting hammer to our aid.

"The key-stone of the building" being removed by his own hands, we shall have little further to do with the rest of his pile, than to keep out of the way of the rubbish. But the real atomic theory will not be injured by his *debris*. Has Dr. Thomson yet to learn that he is not the architect of that edifice, but a very common labourer in the quarry? and that its symmetry and solidity are equally independent of his puny efforts?

The fundamental proposition, that oxygen and hydrogen are to each other by weight in the composition of water, as 8 to 1; and that hence the other chemical bodies may be found, in their atomic numbers, multiples of that for hydrogen, had been demonstrated by Berzelius and Dulong, two of the most accurate experimenters of the age. By transmitting dry hydrogen gas over black oxide of copper, ignited in a tube, and collecting the water produced; they found, on comparing its weight with the loss of weight sustained by the oxide, that the ratio of the hydrogen to the oxygen in water was 1 to 8.009; and since water consists of two *volumes* of hydrogen + one of oxygen, the relation of their densities is, as nearly as can be, $\frac{1}{16}$; whence calling the specific gravity of oxygen 1.1111, that of hydrogen becomes 0.0694.

There is a note to the 72d page of the *Attempt*, which might puzzle posterity. He states that the weight of his *famous flask*, filled with the dilute sulphuric acid and zinc, was about 3000 grains. Yet, a few pages before, he tells us that "the capacity of the flask was about 18 cubic inches," and that it "was nearly filled with a mixture of sulphuric acid and distilled water, in the proportion of about four parts of the latter to one of the former." Now "about 18 cubic inches" of such acid, must weigh fully 5000 grains, and the glass flask itself, of this size, would probably weigh about 2000 more. Hence, with the zinc, its total weight must have been at least twice 3000 grains. Or again, if we take his weight, 3000 grains *versus* his bulk of 18 inches, then the contents (making an allowance of only 1000 grains for his glass) could not have exceeded 7 cubic inches. Is the experiment of the flask altogether a fable, as these palpable contradictions about its weight and capacity seem to indicate?

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* Thomson's Attempt, i. 71.

† The Doctor's estimate of the equation for vapour being about $\frac{1}{60}$ of the real quantity, he accommodated his experiment to this fallacious judgment!

LETTERS AND QUERIES.

GENTLEMEN,—Having in view the erection of a thrashing machine, on a farm in this neighbourhood, I should esteem it as a great personal favour, and one, I trust, which would not be altogether lost on your readers at large, were you, or any of your intelligent Correspondents, to furnish me with a sketch and description, through the medium of your valuable Magazine, of what is considered the most approved principle or plan. I have heard, but have never been able to fall in with any intelligible account of one, invented, I think, by a Mr. Menzies, in which the operation is performed by giving motion to a number of flails, instead of the common method, the scutcher. This, as far as I am at present able to judge, is a great improvement, in as much as the straw will not be cut or broken; the obviating of which, in fact, would render the thrashing mill a perfect machine.

In the expectation of your pardoning this liberty, I remain,

Yours, &c.

J. M. P.

Perth, Oct. 2d, 1825.

[We know that early in the last century, a thrashing machine, of the kind alluded to by our Correspondent, was constructed at Edinburgh by a Mr. Michael Menzies; and we believe that that for which Mr. Meikle took out a patent was something of the same kind. But all the machines which we have seen or heard of, of a similar kind, are far inferior to the worst of those now in use which operate by the revolution of a thrashing scutch furnished with beaters. If our Correspondent is desirous of having a drawing of the most approved plan at present in use, he may let us know, and we shall insert it.—EDS.]

GENTLEMEN,—If you think the following communication deserves a place in your very useful Magazine, you are at liberty to insert it; but if, upon perusal, you find it unworthy of publication, or if my ideas have been anticipated, you will of course suppress it.

I am, GENTLEMEN, yours, &c.

A. E. R.

It is a well known fact, that atmospheric air can be consumed, or at least highly rarified, by means of fire; consequently a vacuum may easily be obtained, in any close vessel filled with air, by injecting flame or fire. Query:—Might not atmospheric air be substituted with advantage, instead of gas or steam, in engines wrought by means of them? In making an experiment of this kind, it would be necessary to have an aperture at the bottom of the cylinder, for the admission of air, to shut and open with a cock or plug. The air is to assist in raising the piston, and when it is raised nearly to the top of the cylinder, the air cock is to shut. Flame is then to be injected, through another aperture at the bottom of the cylinder, by the turning of another cock, which will consume or rarify the air enclosed in the cylinder, and produce the vacuum required. The piston is then pressed down by the weight of the atmosphere, as in the steam engine. The two cocks open and shut alternately, and keep the engine in motion, and at work. This engine will not be so powerful, perhaps, as one wrought by steam, but it will be wrought at the tenth part of the expense, and it is hoped that it might serve many useful purposes.

N. B. The piston will use freely upon the admission of the external air, provided the working beam, or lever, is properly balanced.

Upper Ward, 18th Oct. 1825.

[Innumerable objections might be stated to the above, which is much too obvious a mode of obtaining power to have escaped notice, had it been practicable; but one objection may suffice. It would be a difficult matter to obtain a sufficient vacuum by the consumption of common air; and it would be absolutely impossible to obtain a vacuum with sufficient rapidity, to enable such an air engine to be of any practical utility.—EDS.]

GENTLEMEN,—Can any of your numerous Correspondents inform me what is the best method of keeping the leather of a water-press *soft*; so as to prevent the water from issuing out at the sides, which is the case when it is not kept *soft?* I have been in the habit of using sweet oil, but find that it is very troublesome, for, unless it is almost instantly cleaned off the piston, it becomes very hard, and requires some labour before it be removed.

A. N.

Glasgow, 21st Nov. 1825.

Gentlemen,—Could any of your Correspondents furnish the Magazine with a drawing and description of the late invented Dandy Loom, as no description of it has yet appeared in print?

S. W.

Glasgow, 19th Nov. 1825.

MISCELLANIES.

Brighton Mechanics' Institution.—Mr. M. Ricardo has commenced a course of lectures at the Institution in this town on gas lights, and on the principles of artificial light in general. He stated the plan of this course to be—to give a short history of the first introduction and progress of gas lights, a description of the different apparatus used, a theoretical view of the principles of artificial light, and how it is produced; then to exhibit the mode of making coal gas—oil gas—to explain the operation of producing portable gas—to exhibit different lights, and to show the mode of measuring their intensity. In his first lecture last week, Mr. R., after a short introduction, gave a slight sketch of the rise and progress of gas lights, and then commenced his explanation of the various apparatus used; he had provided himself with suitable models, and the lecture excited great interest.

Sunderland Mechanics' Institution.—We are happy to hear that the Mechanics' Institution of Sunderland is proceeding as prosperously as the most enthusiastic promoters of these valuable societies can desire. The number of the members is now 320, and the course they adopt is such as can scarcely fail to make them increase progressively. They have, for some time past, had a lecture delivered on some scientific subject weekly, and should any circumstance occur to prevent this, their practice is to select a text from a work of reputation, like Parke's Chemical Catechism, that gives rise to a debate, in which all are invited to participate, and which always produces some useful illustration, if it advances nothing in discovery. They had lately three valuable lectures on caloric delivered to them gratuitously by Dr. Brown. They have already three classes formed for mathematics, natural history, and chemistry, which meet regularly, and are making evident progress. We trust their example will be followed by Mechanics' Institutions in other towns; for though they may do much good merely as book societies, there can be no doubt that their usefulness would be incalculably increased, if there were certain periods set apart for a lecture, even if it were ever so homely or familiar, in some department of science.—*Tyne Mercury.*

Periodic time of the Moon.—We observe, in the Liverpool Inquirer for the present month, an interesting paper on the periodic time of the moon, by Mr. J. Baines, of Ebor House, in this neighbourhood. Mr. B. seems to have proved, upon those principles of gravitation on which Sir I. Newton has established the system of the universe, that if the solar action upon the moon should cease, or, in other words, if the sun should be annihilated, the moon would continue to revolve round the earth; but instead of performing its revolution in 27 days, 7 hours, 43 minutes, and 5 seconds, as it does at present, it would then take 48 days, 21 hours, 50 minutes, and 3 seconds, to perform the same.—*Leeds Intelligencer.*

Steam Boats in Canada.—The Legislature of Lower Canada has passed a resolution, authorizing the payment of £500 sterling to any person who shall, within three years, cause a steam boat of 500 tons, or upwards, to be navigated between Quebec and Halifax.—*Demerara Gazette.*

NOTICES TO CORRESPONDENTS.

G. M.; D. W. Fruchie, Fife; J. M., Paisley; R. W., Dunbar, have been received. An Apprentice is informed that there is only one prize altogether, and that it will be awarded to him whose work is best executed, upon a comparison with the others presented, whatever variety of trades they may belong to.

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THE GLASGOW
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

> "Proceed the path of science to explore,
> And then expanding to the beams of truth,
> New energies and charms unknown before,
> Shall to the mind disclose."

No. CIII. *Saturday*, 10*th December*, 1825. Price 3*d.*

IMPROVEMENT ON JUKES' STOMACH PUMP; APPLICATION OF THE SPONGE TO A MACHINE FOR RAISING WATER; UNIVERSAL PLANE, &c.

Fig 2.

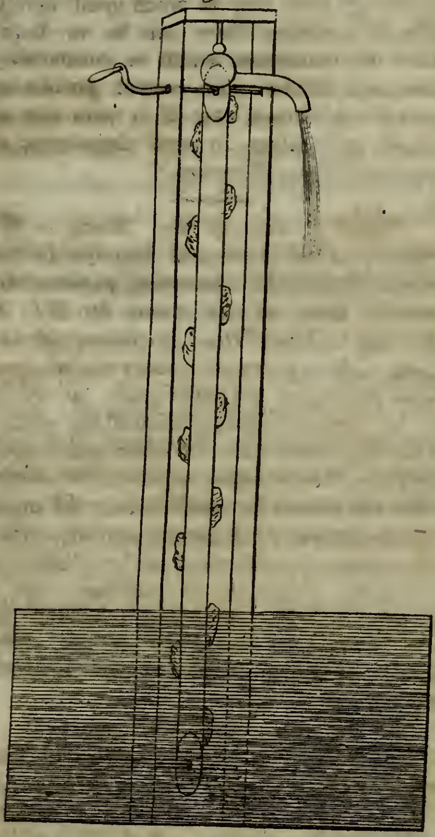
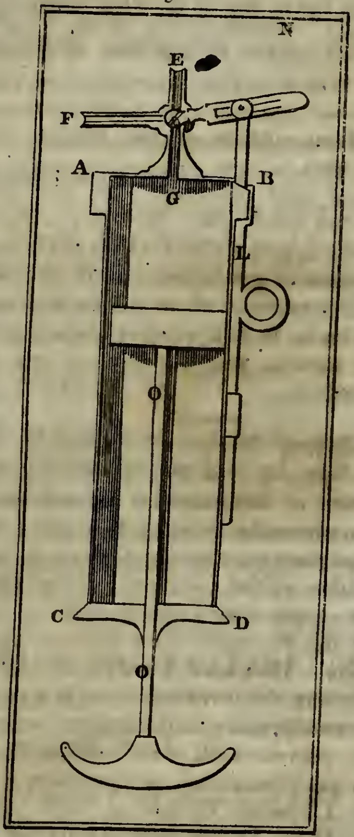


Fig. 1.



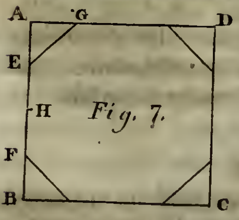


Fig. 7.

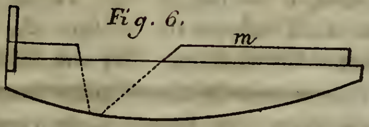


Fig. 6.

Fig. 5.

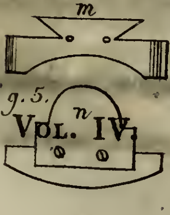
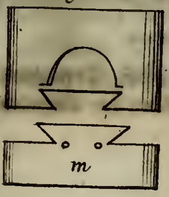


Fig. 4.



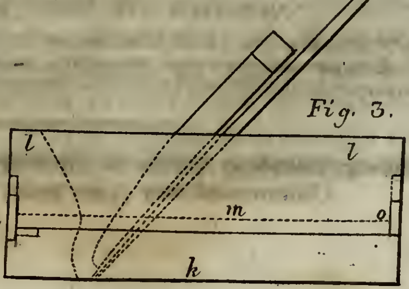


Fig. 3.

VOL. IV.

— Swan. Sc. —

IMPROVEMENT ON JUKES' STOMACH PUMP.

Mr. Jukes' invention for extracting poison from the stomach having been called into use at Newark in England, a short time ago, and the person operated upon, though in skilful hands, having suffered considerable pain and inconvenience from the difficulty experienced in opening and shutting the taps attached to the apparatus with precision and despatch, a gentleman of that place was led to attempt the contrivance of some means for obviating the difficulty on future occasions, and fig. 1 of the plate represents his proposed improvements.

Description of the Plate.

A, B, C, D, (fig. 1,) represent the cylinder or syringe.

E, F, G, a double tap, having a plug containing two orifices, one (H, I,) running through in a direct line, the other (K) cut transversely, so as to meet the passage (H, I,) at right angles.

L, a sliding-rod attached to the arm, M, by means of which the plug of the tap may be turned, so as that a communication between the two apertures, E and F, and the syringe, may be opened or closed at pleasure.

Directions to the Operator.

The accompanying tubes being affixed to the noses of the tap, and the one attached to the point, E, being introduced into the stomach, the operator must grasp the syringe with his left hand, by placing his hand under it, and his middle finger within the ring affixed to the rod, L; then by sliding the hand down the syringe, the arm, M, will be forced to the point, N, and a communication opened with the stomach. The syringe being filled while held in the above situation by withdrawing the piston, O, the operator must slide his hand back, drawing the arm, M, to the point, B, which will close the communication with the stomach, and open the one from G to F, by which the contents of the stomach may be ejected, and so on till the stomach be cleared; then, by reversing the order of the motions, warm water may be introduced into the stomach, and again withdrawn with great speed.

APPLICATION OF THE SPONGE TO A MACHINE FOR RAISING WATER.

By John Murray, F. S. A., F. L. S., &c. &c.

Gentlemen,—Vera's rope pump is a very useless contrivance, and yet has occupied a niche in the volumes of almost all writers on hydraulics. It was in contemplating a model of this pump in the "Conservatoire des Arts et des Metiers," at Paris, that the contrivance I am about to describe suggested itself to me. It may at first sight appear a modification of the chain or bucket pump; but differs very materially from it in principle.

It is hoped the rough sketch (fig. 2,) which accompanies this communication may explain the plan more perfectly. The invention itself is of the simplest description, so there will be no necessity to refer to figures in illustration of the component parts.

An endless *hair* rope passes over two pulleys, one below constantly immersed in the water which is to be raised, the other placed at the summit where the water is emptied, and is made to revolve by means of the attached winch; round the *exterior* of this rope, *sponges* are attached at specific distances; these sponges alternately dip into the water, and are severally raised by the winch to an inclined funnel-shaped pipe at the top, and of this inclined funnel, the discharge pipe is a lateral branch. The sponges are somewhat *cuneiform*, or wedge-shaped; these enter the funnel by their narrow summit, and are compressed in succession, one after another. The water thus obtained from the sponges flows off by the lateral pipe, while the sponge, being compressed and dry, passes through the narrow end of this funnel-shaped receiver, till it is supplied below with water again, by traversing the well or cistern. Here, it will be perceived, is no weight to be raised but that of the water contained in the sponge, and where it is simply retained by the resistance of the air on its capillary orifices—the weight of the sponge itself being fractional. Suppose forty sponges attached to this endless rope, and each sponge to absorb and retain a quart of water, then by every revolution of the rope, no less than ten gallons would be discharged. Here are no valves to be put out of order, nor pump-tree to be choaked up, and I cannot but think the invention is worthy of some attention, on the part of the mariner especially. As far as I know, no similar suggestion has met the public eye, else I should not have troubled you with this.

Yours, &c.
J. MURRAY.

UNIVERSAL PLANE.

THE Society of Arts have rewarded an ingenious carpenter, named Gladwin, for the invention of a plane, which he has constructed so as to answer all the purposes of the jack plane, the pannel plane, the smoothing plane, and the moulding plane. This he effects by having the bottom or sole of the plane moveable, being attached to the body of the instrument by means of a dove-tail groove. The workman, therefore, by being in possession of eight soles, flat, convex, or concave, in different degrees and directions, and of five irons, with one stock or body, has an equivalent for eight separate planes, whereby an advantage is gained, both in point of expense, and also in portability. It is true that some time will be lost in changing the soles, when a man has to pass frequently from one kind of work to another; but after every reasonable deduction has been made on this account, there appears to remain a fair preponderance of advantage in favour of the invention. Care must be taken that the wood employed for the soles is perfectly seasoned, otherwise they may warp and make inaccurate work.

Fig. 3 represents a side view of the plane; *k*, the sole or bottom portion of the plane, being fitted to the upper part, *l*, *l*, by a longitudinal dove-tail, *m*, shown by dotted lines; *n*, a plate of brass, screwed to the upper portion, *l*, *l*, to stop the end of the dove-tail. Fig. 4 is an end view of the upper and lower pieces separate, to show the dove-tail and groove. Fig. 5 represents a concave as well as a convex sole, the latter being furnished with a brass plate screwed to its upper side. Fig. 6 is a longitudinally convex sole.

The following are the directions of the inventor relative to the construction of the plane:

Let one-third of the height of the plane be the thickness of the sole, having a dove-tail fillet, (worked in solid, or glued and screwed on,) about three-eighths of an inch thick, and two inches wide. In the upper part of the body of the plane, make a groove for the fillet to slide in. The sole slides in from the front part of the plane, and secures itself against two brass stops or plates, one screwed on the back part of the plane, the other on the sole in front. The one in the back part answers for all the soles that may be fixed; but each sole must have one in front.

TO MAKE A SQUARE PIECE OF TIMBER OCTAGONAL.

Gentlemen,—If the following theorem be worthy of a place in your useful Magazine, you will much oblige me by its insertion.

I am, yours, &c.

T. A.

Galashiels, 24th Nov. 1825.

To make a square piece of timber, or any other substance, octagonal: Let A B C D. (fig 7,) be the given square, and let any of its sides, as A B, be represented by a, and the part A E, or F B, by x; the part E F will then be expressed by $a - 2x$; but the sum of the square of A E and A G, or F B, is equal to the square of E G, or E F. That is, $2x^2 = (a - 2x)^2$ or $2x^2 = a^2 - 4ax + 4x^2$; or $x^2 - 2ax = \frac{a^2}{2}$. Whence $x = a - \sqrt{\frac{a^2}{2}} = a - \frac{1}{2} a \sqrt{2} = a - .7071\, a = .2929\, a$. And from this we obtain the following general rule;—

Multiply the side of the square by .2929, and the product being set off from each corner, will leave the part E F for one of the sides of the octagon, E G for another, and so with the rest.

Or if the centre, H, be given to find the side: Because $a - 2x = $ E F; $\frac{a - 2x}{2}$ will $=$ E H or F H. Now, $\frac{a - 2x}{2} = \frac{1}{2} - .2929\, a = .2071\, a =$ half the side of the octagon.

Therefore, if the side of the square be multiplied by .2071, and the product set off from the centre, on each side, it will form the octagon as before.

ON THE CAUSES OF THE VARIETY OF COMPLEXION AND FIGURE IN THE HUMAN SPECIES.

[Continued from page 248 of the present Volume.]

A few observations may be here offered on another variety of our species, composed of the Danish, Swedish, and Muscovite Laplanders, the inhabitants of Nova Zembla, the Borandians, the Samoeides, the Northern Tartars, the Ostiacks of the old continent, and the Greenlanders, and savages north of the Esquimaux, in the new continent, who appear to be all of the same race, and who have extended and multiplied along the coasts of the North Sea, in deserts and under climates which could not be inhabited by other nations. Their stature is small, their heads are disproportionably large, their shoulders raised, and their necks short; their eyes are small, and appear, by the jutting of the eye-brows over them, to be sunk in the head; their cheekbones are prominent, their noses flat and short; their mouths are large, and their lips thick and deformed; the under part of their face is narrow, and their features are remarkably coarse; their skin is of a tawny or swarthy hue.

It seems extremely probable, that all this, however difficult it may be to explain every circumstance, is owing to extreme cold, the difficulty of finding subsistence, and other circumstances connected with their situation. Their small stature may be ascribed to the cold and scanty food; the inhabitants growing up under the constriction of continual frost, which compresses their body like a powerful machine. Coarse and deformed features seem to be the necessary consequence of such a climate, for we know that extreme cold contracts the aperture of the eyes, draws down the brows, raises the cheek by the pressure of the under jaw against the upper, diminishes the face in length, and spreads it out at the sides, until, distorting the shape, it ultimately produces the permanent character of northern nations.

This subject naturally leads to the consideration of the state of society, as affecting the appearance of the human species.

It has been remarked that the effect of climate is augmented by a savage state, and corrected by a state of civilization. War is the chief concern of the savage, not the enjoyment of domestic life; he has a view to this even in painting and decorating his person, and little can he regard the convenience or neatness of his hut, who, at night, must often, in quest of food, or marching against his foe, repose on the bare ground, sheltered only by branches and leaves of trees. He is thus exposed to the full influence of the atmosphere, and to its noxious effluvia, arising from stagnant pools and putrid vegetable matter. The intense heat of the sun, the smoke of his ill-constructed hut, when he repairs to it, and the pigments employed by him in painting his skin, must certainly spoil the fineness of its texture, and impair the beauty of its natural colour.

Add to these circumstances his mode of subsistence, now faring scantily—now surfeiting; and considering all these, the conclusion seems unavoidable, that it is impossible for a savage, independent of climate, ever to be fair.

The state of society among ourselves occasions a remarkable diversity. The hard labour of our poor, such of them, especially, as are exposed to the influence of the sun and the inclemency of every blast, their coarse and scanty food, and the damp and unhealthy hovels in which, especially in great towns, many of them are obliged to live—all contribute to give their features a certain harshness and swarthiness, which we do not find in persons of better fortune and of more liberal subsistence.

The last cause of the varieties among men which time permits us to mention, is the power which he possesses over himself of producing changes in his form, according to any standard of beauty which he may have by chance adopted.

The Tartars admire large ears and small eyes, and they accordingly append weights to their ears, draw them down with their hands, and cut their margins, by which they succeed to extend them to their shoulders; while, to procure small eyes, they are at great pains to compress them at the angles, The Greeks and Arabians, again, employ great pains to have large eyes, which they esteem highly beautiful, and, with this view, stretch the eye-lid, and extend their apertures. In China, they compress the feet of the females; and in a similar manner in Caffraria, and other parts of Africa; and in Lapland, customs akin to those just mentioned are commonly practised.

What was above noticed ought ever to be kept in view—that the parallel of latitude does not uniformly indicate the same temperature of heat and cold. If the torrid zone of Asia possesses inhabitants of a hue less dark than those of Africa, we have in Africa, we should remember, a region of burning sand, augmenting the heat of the sun to a prodigious degree. Asia, on the contrary, has large lakes and rivers, the sea in many parts runs far into its continent, absorbs the rays of the sun, and fills the atmosphere with a cool and humid vapour; while in summer, the winds blow from the south across extensive oceans, in the winter from continents which the sun has long deserted.

The above are a few of the most striking causes of the variety of complexion and figure in the human species, and although many more might be mentioned, a sufficient number have been advanced to account fairly, and upon what we esteem rational principles, for the diversity so strikingly observable in these circumstances.

Q. Q.

ON THE DISEASES INCIDENT TO MECHANICS.

By a Physician.

On the Diseases of Printers.

The first circumstance which strikes me, in adverting to the diseases of printers, is the incessant and severe use of the eyes which their business requires. To this is to be attributed the not unfrequent affections of this organ which this class are liable to; the preservation of which, in its vigour, is so essential to the full enjoyment of life, and to the exercise of the powers and faculties of the mind. The constantly holding the eye over black characters and types, proves a source of irritation to the eye, advancing finally to inflammation, of a slow kind, and disorganizing its internal textures, indicated by dimness of vision, or the change of that part of the eye called the lens and its capsule, constituting Cataract, or Gutta Serena; and instances are on record, where the fear of total blindness has caused some to abandon the trade. I have been told by some compositors, that, after a hard day's application, they still continue to have dazzling representations of characters before their eyes for hours, nay, sometimes during the whole night. This is, of course, attended with imperfect vision of surrounding objects.

In the Dictionary of Medical Science, there is narrated a curious effect which this occupation has over the countenances of the printers. It is not, however, a dangerous one; accustomed to pronounce each letter as he puts it in its place, the workman perhaps makes three or four ineffectual efforts to seize the type, to each attempt there is an accompanying change of the muscles of the countenance, or grimace; and this has in some become habitual.

Formerly, the labour at the press was severe and excessive, and we, as was natural to expect, found all the diseases of hard labour and their consequences attendant on this part of the trade; such were, ruptures and dilatations of the blood-vessels, called *aneurisms;* and from exposing themselves when warm, and sweating, they were liable to colds, and inflammations of the chest. Since the progress of art, however, has rendered their labour easier, fewer of these diseases are met with in this class of tradesmen: and the unhealthy look, indigestions, rheumatisms, scrophulous affections of joints, and dropsies, not unfrequetly met with among them are owing to excess in spirits, the unwholesome situations too often selected for the printing offices, carelessness in clothing and sedentary occupation. I am, however, happy to pay the compliment to the superior moral rectitude of this class in our city, that their use of ardent spirits is by no means so great as in London and the large continental cities, such as Paris and Vienna.

The erect and steady posture they maintain at their work gives rise to swellings of the feet and ankles, a tendency to enlargements of the veins of the lower extremities, and ulcers of these parts. Lead, which enters into the composition of the types they handle so much, has sometimes the most deleterious properties on the human constitution. It produces the most excruciating cholic, with loss of power of the lower extremities, and often baffles the most skilful. I must say I have never in *a printer* seen a case of this affection, yet others have sufficiently often to render it a necessary precaution to use the means adapted for its prevention. I have seen printers put the types into their mouth, a practice which cleanliness and the preservation of their health strongly point out should be abandoned. Very ill conditioned sores have been observed to follow a cut on the hands of printers, from the introduction, through inattention, of some of the matters they handle into these wounds.*

To excess and irregular hours, I have traced many of the affections to which this class are exposed, especially in those who are employed at the press. The compositors, I think, oftener enjoy good health, as far as regards the general functions of the body, which is, perhaps, referable to their more improved understanding leading to more regular habits and steadiness of conduct. The fatal consequences of indulgence are visible in the sad victims of disease our hospitals present. How often have I been *doomed to see constitutions* sinking under excess and irregularities, which would have otherwise reached a lengthened period of respectable old age through a life of honest usefulness! Printers have an illustrious example in one of their own body, of the happy consequences of industry, economy, and rational abstinence; and when the allurements to sinful indulgence or idleness would entice them, let them remember BENJAMIN FRANKLIN.

To be continued, on the prevention and cure of these affections.

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* This, a very intelligent printer tells me, he attributes to the antimony entering into the composition of the types. The same opinion, I believe, also prevails among the journeymen.

GLASGOW MECHANICS' INSTITUTION.

SUBJECTS FOR ESSAYS PROPOSED BY MR. DEUCHAR FOR THE STUDENTS ATTENDING HIS CLASS.

FOR the advantage of our numerous Correspondents and Subscribers, and more especially those belonging to the above valuable establishment, we mean regularly to insert all the questions which Mr. Deuchar may, from time to time, give out for exercising the talent and ingenuity of his pupils. We shall distinguish the prize questions by prefixing three stars to them.

Those who mean to compete for any of the prizes, must attach to their solutions a peculiar motto, a duplicate of which must form the superscription of a letter containing their name and address.

The solutions of all those questions for which there is no prize awarded, ought to be accompanied by the authors' names.

1. If an unmagnetised sewing needle be cautiously floated on water, pointing east and west, it turns round till its eye is directed to the south, and the point to the north. Two questions arise here: why does the needle thus turn round? and why does the sharp point rather than the other end turn to the north?—Answer required before 1st Jan. 1826.

2. A lump of camphor, exposed in a room 30 feet long, 20 feet wide, and 15 feet high, looses one grain in 40 days; supposing the air to be removed 3 times every day, what portion of its weight will this air suspend of the aromatic matter in solution, each cubic inch of air weighing $\frac{3}{10}$ths of a grain?—Answer required before the 17th December.

⁂ 3. If we scrape with a knife a little camphor over newly poured out water, each scraping when it touches the water commences a revolution on its centre. Again, if a piece of lighted camphor be put upon newly poured out water, it runs about in a serpentine direction. Now, what is the cause of both of these movements?—Answer required by the end of January 1826.

4. What is the cause of the noise produced by the instrument denominated the "Water Hammer?"—Answer required by 17th December.

5. What produces the appearance of boiling when the hand is applied to the "Water Hammer?" In this question may be also included the reason why a "Water Hammer" with a narrow neck continues its pulsations and noise for a considerable time after it is laid upon the table?—Answer required by 21st January 1826.

6. What are the characteristics of chemical and mechanical action?

⁂ 7. What are the arts most dependent upon chemistry, and in what respects have these been benefited by that science?—Answer required by the end of March 1826.

⁂ 8. What are the arts most dependent on mechanics, and in what respects have these been benefited by that department of science?—Answer required by the end of March 1826.

NEW POWER-LOOM.

By Mr. George Whyte, Glasgow.

Gentlemen,—Having in your last Number given a general outline of the system on which my Power Loom is constructed, I shall now proceed to give a particular description. I shall retain the order in which the movements are arranged and described—1st, the movement of the cloth beam, then the movement of the lay, and lastly, the forming the shed, and the movement of the shuttle.

1st, The movement of the cloth beam. On the end of the cloth beam, *a*, represented in fig. 3, No. XCVIII. is a wheel, *b*, of 84 teeth. This wheel is turned by a pinion of 12 teeth. On the axle of this pinion is a wheel, *i*, of 64 teeth. The wheel, *i*, is turned by another pinion of 12 teeth. On the axle of this pinion is the ratchet wheel, *m*. It has 32 teeth on the inside, and 32 on the outside of the rim. Inside of the rim is a small wheel which turns on the axle of the ratchet wheel. It has two small levers screwed in it, the one above the other. The lower one turns within the circle of the rim, and has a joint with a spring upon it, which acts on the inside teeth. The upper lever is placed so as not to touch the rim in working. It is joined to the journal, *k*, which connects the wheels to the lever, *k*, (fig. 2, No. CII.) of the concentrator. A claw-footed catch, marked *n*, (fig. 3, No. XCVIII.) screwed to the frame of the loom, acts on the outside teeth, to prevent the wheel from moving backward. This movement, as we have described, takes over the cloth at every two shots, but it might not be improper, in fine lawns, to take over the cloth at every shot; hence the ratchet wheel has teeth outside and inside. There must be two small wheels on the axle of the ratchet wheel; each of these wheels must have a journal. The upper wheel, projecting beyond the rim, must have a joint and a spring upon it, to act on the outside teeth. One of the journals must be joined to the lower wheel, and the other journal to the upper wheel, on the axle of the pinion; so that the journals, in working, cannot touch each other. The journals must be joined to opposite sides of the concentrator.

2d, We shall now proceed to the movement of the lay. The lay is driven to the fell by the spring, *m*, represented in fig. 2, No. CII. The spring does not immediately act on the lay, but on the player, *o*, which communicates the power of the spring to the lay. The spring is regulated by a screw bolt, which passes through the casting, *n*, to which the spring is screwed, and to which the player, *o*, consisting of two rods, connected at the top with a pulley, moving at the centre, 6, is joined. Thus the spring is regulated in its action on the lay, so as to put on more or less shots, according to the nature of the fabric. The pulley of the player, *o*, runs on a piece of wire, fastened on the sole, to guard its action. The spring and player are placed so as to act exactly on the middle of the sole of the lay. The lever, *q*, of the represser, *r*, passes between the rods of the player, and is connected to the under side of the sole of the lay, *p*, as represented in fig. 2. The under levers, *s*, *s*, of the represser, are connected to the levers, *l*, *l*, of the concentrator.

3d, The movement of the shuttle is now to be described.

The shuttle is driven by two springs, *f*, *f*, one on each end of the rocking-tree, acting on the wipers, or shuttle-shafts, *e*, *e*, represented in fig. 1, No. XCVIII. The wipers are connected on each side of the loom by the cords, *d*, *d*, to *c*, *c*, the shuttle repressers. The repressers, *c*, *c*, connect the wipers with the main shaft, *u*, represented in fig. 2, No. CII. The main shaft is connected at *t*, to the lever, *k*, of the concentrator. The springs, which are of the same construction as those which have been described in the movement of the lay, are fixed in the frame, in which the wiper works, as represented in fig. 2, No. XCVIII. It is necessary, when the wiper is repressed, that it should be retained in that position while the lay is driving home the shaft; hence the use of the catch, *k*, as seen in the same figure. The wiper works in the groove; when the right hand wiper is repressed, it presses against the inside catch, which, being connected with the outside catch, *k*, throws the catch into the groove, and incloses the wiper. The inside catch, connected by a cord to a lever fixed on the frame, is connected by a cord, to the lever of the catch on the opposite side. This cord connects it to the shuttle-repressers, *c*, *c*; when the shuttle-represser, therefore, is drawn back, the wiper on the opposite side is disengaged, and the shuttle thrown through the shed, while the other wiper, drawn back by the represser, is inclosed by the catch, *k*. The shuttle can be thrown into the shed by a screw in the represser, *c*, *c*, to which the cord is fastened, at any point in the movement of the lay. The shed is immediately connected with this movement. The treadle-cords are fastened to the treadles, *x*, *x*, in fig. 2, No. CII. and passing under the two pulleys at *h*, in fig. 1, No. XCVIII., in the frame of the concentrator, are fastened to the main-shaft, *u*, at *w*, (fig. 2, No. CII.) The points, at the pulleys immediately below *g*, *g*, (fig. 1, No. XCVIII.) show the places to which the pulleys are removed, to increase or diminish the shed.

Thus all the movements are connected to the concentrator; the movements of the cloth beam, of the shuttle, and of the shed, are connected to the lever, *k*, of the concentrator, represented in fig. 2, No. CII. The movement of the lay, connected to the levers, *l*, *l*. The lever, *k*, is the regulator of the movement of the cloth-beam. If too much is taken over, remove the journal nearer to the centre of the concentrator. The movement of the lay is adjusted by screws in the levers, *l*, *l*, of the concentrator, to which the cords connecting the represser, *r*, to the concentrator, are fastened.

The concentrator being the grand *primum mobile*, so to speak, of the whole, it is proper to say a few words respecting it. When the levers are parallel with the bar on which the concentrator is supported, all the parts of the loom are at rest. But whenever they are drawn out of this position, the motion takes place, and when they have described an arc of a circle, amounting to one-twelfth of the circumference, all the movements are at their full stretch; when the space thus described is retraced, and as much space is described in the opposite direction, then all the movements of the loom are produced. The concentrator moves upon centres or pivots, at 4, 4, and is made to oscillate in an arc of about one-sixth of the circumference of a circle in whole, from side to side; that is, one-twelfth of the circumference on each side of the supporting bar. By turning the handle at *a*, fig. 2, No. CII. which is fixed in the concentrator, the whole of the movements are produced.—I am, &c.

GEO. WHYTE.

ON THE ADULTERATION OF CONFECTIONS.

EVERY species of confection sold, is more or less adulterated, and often with very pernicious ingredients. The common carroways are adulterated with the cheapest American flour that can be bought, and this varies from 25 to 100 per cent. according to the part of the country they are intended to be sent to. Common peppermint lozenges are adulterated with flour, plaster of Paris, Derbyshire spar, starch, arrow-root, &c. &c. instead of being made, as they ought be, of pure sugar and gum. The best way to test confections is to put a portion of them into a quantity of warm water, and allow it to stand till cold; the confections will then be dissolved, and the adulterated composition will fall to the bottom of the vessel in which the experiment is tried.

A CONFECTIONER.

REVIEW OF DR. THOMSON ON THE ATOMIC THEORY.

[From the London Journal of Science.]

(Continued from page 254 of the present Volume.)

DR. THOMSON'S Fourth Chapter, on the atomic weights and specific gravities of chlorine and iodine, is remarkable only for dogmatical pretension, and eulogiums of experiments of which he should be ashamed. Thus, he refers to his specific gravity of chlorine gas, given in the 16th volume of the *Annals*, because he brought out the number 2.5, so as to tally with Dr. Prout's theory, though the gas, being saturated with humidity, should have had, *experimentally*, the specific gravity of 2.4837, compared to moist air, 1.000. Then, indeed, the chlorine in its dry state would be to dry air as 2.5 : 1.0. This trick of obtaining the atomic multiple numbers, in circumstances where they cannot be found, reminds us of a star-gazer, who, furnished with a little quadrant, took it in his head to verify and correct the zenith distances of the stars. Disdaining the equations for refraction, nutation, aberration, &c. he contrived, however, to make his results come very near to the places given by Dr. Maskelyne, and hence was looked up to by his little *coterie* as a great astronomer.

We shall here introduce an example of Dr. Thomson's experimental reductions, on a very simple matter. "I find that at the temperature of 69°, one cubic inch of water is capable of absorbing 417.822 cubic inches of muriatic acid gas. The temperature of the liquid augments considerably, and its volume, when cooled down to the temperature of the air, is 1.3433 cubic inch. It is obvious from this, that 100 grains of acid of this strength contain 103 cubic inches of acid gas; and a cubic inch of this acid contains 311.04146 cubic inches of acid gas. Acid of this strength has a specific gravity of 1.1958, and I find, by saturating it with calcareous spar, that it contains 40.39 per cent. of real acid, united with 59.61 of water. In winter, I have obtained muriatic acid of as high a specific gravity as 1.212."*

In this congeries of blunders, it is hard to say whether his experiments or calculations be most in fault.

The specific gravity of muriatic acid gas is rated by him at 1.28472.

1. The weight of a cubic inch of water + 417.822 cubic inches of mu-

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* Attempt. Dr. Thomson may find a manufacturer of muriatic acid in Glasgow, who will supply him in winter with acid at 1.220.

riatic acid gas is 252.5 gr. water + 163.72 gr. gas = 416.22 gr. of liquid acid; and 416.22 : 163.72 : : 100 : 39.53.

Thus 100 grains of this liquid acid manifestly contain 39.33 grains of acid gas, and not 40.39, as he asserts.

2. 416.22 grains of water occupy a volume = 1.6484 of a cubic inch; but he tells us that the 416.22 gr. of liquid acid have a volume = 1.3433 cubic inch. Hence the specific gravity of the liquid acid is $1.227 = \frac{1.6484}{1.3433}$. But Dr. Thomson *asserts* that it was 1.1958, an incompatibility which we leave him to reconcile.

3. If the water bulk of the above weight of acid be divided by Dr. Thomson's specific gravity of the acid, we shall have its volume. Thus, $\frac{1.6484}{1.1958} =$ 1.379 cubic inch = 348.1975 grain measures; and conversely its weight in grains, divided by its bulk in grains, is its specific gravity $= 1.197 = \frac{416.22}{348.1975}$.

After floundering through this mire of miscalculation, the Doctor has the modesty to say, "All the tables hitherto published, exhibiting the strength of muriatic acid of various specific gravities, are very erroneous, because they were constructed upon inaccurate data. I conceive, therefore, that it will be worth while to exhibit an accurate table of the specific gravity of this acid of determinate strengths. My method was, to saturate a given weight of the acid with calcareous spar." This is to out-Herod Herod. "My method," as he calls it, is the old and usual one, and was that employed in constructing a table of muriatic acid, published in his own Annals of Philosophy for October, 1817. But the method with nitrate of silver is incomparably more delicate and precise.

What are we to think of that man's candour, who, after asserting that *all* the tables of muriatic acid hitherto published are *very erroneous*, gives as his own discovery, and as a standard of truth, a little table, of which the fundamental numbers, *viz*. the specific gravities corresponding to quantities of acid per cent. are *apparently* taken, without acknowledgment, from a very extensive table of muriatic acid published in this Journal, for January, 1822. The slight disguise that the Doctor has put on his numbers, will never make them pass for his own.

Table in Journal of Science, Jan. 1822.

Specific Gravity.	Acid in 100.
1.200	40.777
1.1846	37.108
1.1620	32.621

Table in Dr. Thomson's Attempt, 1825.

Specific Gravity.	Acid in 100.
1.203	40.659
1.179	37.000
1.162	33.945

The fundamental strength at specific gravity 1.20 is that from which the numbers in the tables are deduced, and it is as nearly as may be the same in both. We are confident that Dr. Thomson's small deviations from the numbers given in our Journal for 1822 are errors; but supposing them not so, the differences are so inconsiderable, as not to entitle the Doctor to say all the former tables were "*very erroneous.*"

In his Fifth Chapter, Dr. Thomson treats of the atomic weight of azote, and specific gravity of azotic gas. The usual felicity of coincidence between experimental and theoretic numbers attends his attempts here—a felicity, however, which he had not the courage to claim a very few years ago. In his long paper on the specific gravity of the gases, published in the 16th volume of the *Annals*, (Sept. 1820,) he says, "When 100 volumes of air are mixed with 42 or 44 volumes of hydrogen gas, and an electric spark passed through the mixture, the diminution of bulk ALWAYS amounts to 63 volumes."* His "hydrogen was then prepared from pure redistilled zinc, pure water, and pure sulphuric acid, with the requisite precautions." Mark his language now:—"A mixture of 100 volumes of air, and 42 volumes of this pure hydrogen gas, was fired by an electric spark. The diminution of bulk in three successive experiments was precisely 60 volumes."

What confidence can be reposed in such plastic results?

He tries to analyse nitre by igniting it in contact with iron filings contained in a copper tube. "Here chaos is come again;" but we shall keep it, if possible, out of our pages.

He favours us in this chapter with a

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* Page 163.

brief table of liquid nitric acid, which seems to be taken, without acknowledgment, from a copious table published seven years ago in the 8th number of this Journal.

Table in Journal of Science, Jan. 1818.

Specific Gravity.	Acid in 100.
1.4855	75.000
1.4530	66.948
1.4189	59.775
1.3945	54.993
1.3630	50.211
1.3001	40.647
1.2765	37.459
1.2402	32.677
1.2212	30.286
1.2084	28.692

Table in Dr. Thomson's Attempt, 1825.

Specific Gravity.	Acid in 100.
1.4855	75.000
1.4546	66.668
1.4237	60.000
1.3928	54.545
1.3692	50.000
1.3032	40.000
1.2844	37.500
1.2495	32.574
1.2173	30.000
1.2012	28.571

A table of the atomical relationships of acid and water, at different densities, is given at p. 24 of our Journal of January, 1819, from which Dr. Thomson's atomical table does not differ; yet he never alludes to these researches which so long preceded, and in fact superseded, his own. That nitric acid of specific gravity 1.55, consists of 1 atom of real acid + 1 atom of water, was stated in a well-known chemical publication several years before Dr. Thomson's Attempt appeared. His table descends no lower than to 1.2012; and it obviously ranges itself as evenly by its predecessor, as decency would permit. We are certain that the differences, however small, will do no credit to Dr. Thomson's character as a chemist.

In the 6th edition of his system, oxalate of ammonia is said to consist of 4.5 oxalic acid + 2.125 ammonia. But no such compound exists. In discussing ammonia, under azotic gas, he now describes the oxalate as composed of 1 atom acid + 1 atom ammonia, + 2 atoms water = 8.875. This atomic weight of the crystallized oxalate of ammonia was first given in the Philosophical Transactions for 1822.

(To be continued.)

THE PAINTER'S AND VARNISHER'S POCKET MANUAL.*

THIS little volume must prove extremely useful to those for whom it is intended, as it contains all the useful information connected with their business, which has been hitherto scattered through a number of different works, many of which cannot be supposed likely to fall in the way of mechanics. Much has been done for bringing into the hands of mechanics a knowledge of the principles and operations of their several trades; and certainly to none, from the nature of their employment, will this prove more beneficial than to the painters and varnishers. In this treatise, the general observations on the various operations of the trade are distinct and concise; the receipts for preparing paints and varnishes are numerous and valuable; and there is, what must prove of very great value, an account of the principal adulterations practised upon articles used in the trade, with the best and readiest modes of detecting them. There are also some observations on the numerous accidents and peculiar diseases to which painters and varnishers are more particularly exposed, with the best means of prevention and remedy, and proper cautions against the injurious and injudicious attempts at cures which are too frequently made. This work must then be useful to the painter; and, from the receipts and instructions which it contains, it must prove beneficial to all those who, residing at a distance from painters, find it sometimes necessary to paint for themselves. We extract the following observations on *Painting in Distemper*:—

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* London; Knight & Lacey. Glasgow; W. R. M'Phun. 1825.

"The full manner in which the subject of colours has been treated, will render it unnecessary to make many observations on the subject of Distemper. The leading difference between oil painting and painting in distemper is, that in the latter the colours, instead of being prepared with oil, are mixed with size and water. This circumstance renders many colouring substances, particularly some that contain chalk, or clayey earth, or are extracted from vegetable matter, proper for the purpose of distemper, which cannot be used in painting in oil.

"Almost all colouring substances which can be used in oil painting, are applicable in distemper; but the reverse, as will appear from the remarks I have just made, is far from being the case. In speaking of colours, care has been taken to notice particularly such as, from their nature, can be employed only in distemper.

"In painting in distemper, it is advisable to apply all the coatings, except the last, warm; not, however, in a boiling state, for that is injurious, and may cause wood to split. Besides, if the size be too much heated, it becomes fat, and will not adhere. In putting on fresh coatings, be very careful to preserve an equal thickness throughout.

"Without the utmost attention to having the ground you are to work upon perfectly clean, no pleasing effect can ever result from distemper. Grease and lime on the surface that is to receive it would ruin all. They must be removed by scraping, if the surface be a wall, and by a solution of pearl-ash if it be wood. Canvass must be cleaned by means of a ley.

"When the wall or surface is very smooth, a coating of warm glue is first applied; but if rough, a coat of Spanish white, or chalk mixed with a solution of glue, is employed to render the surface smoother; and when the coating is dry, it is scraped as clean and as even as possible. A level surface is indispensable to receive distemper. If there are any considerable inequalities or holes, they must be filled up with gypsum, and time allowed, before applying any coat, for that gypsum to gain body, which will not be the case before it is thoroughly dry.

"In painting in distemper, the thickness of the colour, contrary to the observation I made on that head in oil-painting, should be such that it may run or drop from the brush in a thread when taken from the pot. If the colour does not form a thread, it is too thick, and the work is likely to become scaly.

"Distemper is much used in the interior of houses, and, when well executed, has a very delicate and beautiful appearance. It is likewise free from the disagreeable smell which usually arises from turpentine in oil-painting. It is, however, far inferior to oil, both as to the durability of the colours, and to the preservation of the surfaces on which it is applied. In some cases, too, it is attended with the inconvenience of not enabling the workman to see the effect of it till it is dry. When this happens, the only method of obviating it is to try each mixture on pieces of prepared wood having the same tint as the ground on which you are working, so as to obtain the real tint. A kind of distemper, called by the French *badigeon*, is sometimes used in out-door work, to give an uniform tint to houses rendered brown by time, and to churches, where it is required, to render them brighter. It has generally a yellow tint. The best kind is made by mixing the saw-dust or powder of the same kind of stone and slaked lime, in a bucket of water containing a pound of alum in solution. The composition is applied with a brush."

LETTERS AND QUERIES.

Gentlemen,—In your last Number, there is a drawing and description of a perpetual motion, invented by Mr. Vallance of Lanarkshire. Let us examine, for a short time, this new prodigy in mechanics, and see if any power can be gained by it, or even if it is able to move itself. The machine consists of a wheel with twelve hollow spokes, each spoke being open on one side of the wheel, from the centre to the circumference. Into each spoke there is a weight or ball, which moves or rolls in the spoke. There are also two pulleys placed obliquely across the frame of the machine, over which a chain passes. This chain touches the spokes of the wheel, and is for the purpose of raising the weights to the centre, when they roll out (as the wheel turns) to the circumference. There is nothing in all this that will give a perpetual movement: let us put our hand to the circumference of the wheel, and put it in motion. The weights in the spokes will no doubt move out on one side, as the wheel turns round. They will exert their force in moving the wheel, but will be opposed by as great a power, namely, the chain raising the weights again to the centre, so that the power gained by the weights at the circumference is completely counterbalanced by the power which it takes to lift them again to the centre, so that no advantage whatever is gained, and, consequently, no perpetual motion.—Mr. Vallance says, "the weights are on one side only of the wheel, always at the circumference, so that that side is more powerful than the other, which causes the wheel continually to revolve." He does not consider that the side which he says is more powerful is met by an equal power in the weights rising to the centre. Mr. V. surely never made a model of it, or he would have seen that he was altogether in a mistake.

I am, yours, &c.

B.

Port-Glasgow, 30th Nov. 1825.

GENTLEMEN,—In your last Number, Mr. Dixon Vallance gives an account of a perpetual motion of his invention, which appears to be half joke, half earnest. He has left his readers to infer that it is going on without interruption, but has not positively asserted it, so that I fear he is playing Will-o'-the-wisp himself, in order to wile some poor perpetual-motion genius into the mire; for so enticing is this jilt, that I have known some so eager in the pursuit as to try plans that had been tried before, and proved not to go one round, hoping, no doubt, that she would prove more propitious to them, and not go off hop-step-and-jump, whenever she got clear of their fingers. But, jesting aside, if Mr. V. had seriously affirmed that his machine is actually going, we must have believed him till the contrary was proven; but in the figure there are three balls represented as ascending nearly in a perpendicular direction, while only two are in action to produce the effect. Something farther on the subject from Mr. V. or remarks by any of your ingenious Correspondents, would no doubt be very gratifying to many of your readers.

I am, yours, &c.

G. M.

Glasgow, 28th Nov. 1825.

GENTLEMEN,—The following is an inscription upon the large bell in the Cross steeple, which is in as good preservation as the hour it was put up, notwithstanding so much exposure to the weather:

"Kathelina ben ic Ghegoten van jacod Waghevens int jaer ons hevens, 1554."

Its age seems to be two hundred and seventy one years. Should any of your Correspondents translate this, it will oblige,

Yours, &c.

W. G.

Glasgow, Nov. 1825.

GENTLEMEN,—I feel much for your Correspondent with his *New Kail Pot*, which he finds himself so unable to get made *old*, and shall be glad to lend him my assistance. I know not what mode was adopted by our ancestors who were so fond of their far-famed "Kail Brose," but I should suppose they knew better how to manage their *new* ones, or else they always used *old* ones, for we hear of no complaints as to the colour of their brose. I would, however, advise your "Admirer" not to consign his pot to oblivion during his life, although by the period of his death, as he seems to think, it will alone be fit for use, but to try the following method:—Let him fill his *new* pot with clean water, and place it on the fire till it begins to boil; then let him take it off, and pour in twopence worth of oil of vitriol, covering it well up, so that nothing may escape; let it then stand for a period of two hours, at the end of which time, he will find, by the colour of the water, that it has not been idle; and I suspect that after this he will have few complaints to make about the colour of his broth, which he seems so desirous to have clean and white.

I am, yours, &c. J. B.

Comrie, 28th Nov. 1825.

MISCELLANIES.

New Water-Machinery.—A Mr. G. F. Reeve, of Orange County, New-York, has constructed an engine to transport goods or articles by aid of water, where there is a sufficient quantity and fall for any given distance. Its leading principles consist of a wheel and axis, with floats or buckets, adapted to a race or trough, whose angle of incidence is adapted to the fall, or other circumstantial conveniences. Upon each end of the axis of this wheel is a cog-wallow wheel, which works into a rack or cog plate, placed upon the top on each side of the race, and which answers, for what may not improperly be termed a railway. The engine being situated at the foot of the race, the water is let in, and operating upon the floats turns the wheel, and by the wallow cog-wheels of the axis of the water-wheel being geered with the rack on the race, the wheel ascends; and by a more or less partial supply of water, the water-wheel is made to descend with the velocity required.—*American Paper.*

Machine for digging Potatoes.—Mr. Michael Barry, of Swords, has invented a machine, simple in its construction and principle, by which, with two horses and one attendant, an acre of potatoes can be dug out in one hour: also, an acre of ground, previously ploughed for oats or other grain, can be harrowed by it in an hour with two horses and one attendant, thereby effecting, in the branch of harrowing, a saving of upwards of 93 per cent.; or, in other words, doing the work of 32 horses and 16 attendants, with two horses and one attendant.

Manufacturing Ice.—An apothecary of Caen, in Normandy, has just discovered a method of procuring ice at all seasons of the year, by mixing four pounds of sulphuric acid (oil of vitriol), 36 deg. with five pounds of sulphate of soda (Glauber salts, in powder). This mixture must be made in an earthen-ware or china vessel, and the water which it is wished to congeal must be put in it in a separate vessel wrapped round with flannel, cotton, thick paper, or some other non-conductor of heat, and the operation must be repeated three times on the same body of water.

Cheap Aromatic Vinegar for purifying large Buildings, Manufactories, &c.—Take of common vinegar any quantity, mix a sufficient quantity of powdered chalk or common whiting with it, as long as bubbles of carbonic acid gas arise. Let the white matter subside, and pour off the insipid supernatant liquor; afterwards let the white powder be dried either in the open air or by a fire. When dry, pour upon it, in a glass or stone vessel, sulphuric acid as long as white acid fumes continue to ascend. This product is similar to the acetic acid known in the shops by the name of aromatic vinegar.

New-Invented Silk Loom.—A loom has recently been made at Lyons for silk-weaving, which has many advantages. It is composed of five stages, and the mechanism, which is simple, allows one man to weave five pieces at the same time. The loom has been examined by the Commissioners from the Academy of Lyons, in company with Mons. Jacquart, the inventor of that sort now in use, and which was imported into England with great haste, tending to prove its great advantages. M. Jacquart is of opinion that the new invention is of great importance, and he has pointed out some improvements in it. The inventor is M. Lebrun, and the Academy intends to confer a gold medal on him. By this loom a saving will be made of four-fifths in the expense of labour.—*Courier Francais.*

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THE GLASGOW
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

"However bad the world may be, the extremes of wretchedness are to be found among those who do not read."

No. CIV. *Saturday, 17th December,* 1825. Price 3*d.*

MR. BROADMEADOW'S PATENT PROCESS FOR GENERATING AND PURIFYING GAS, &c.

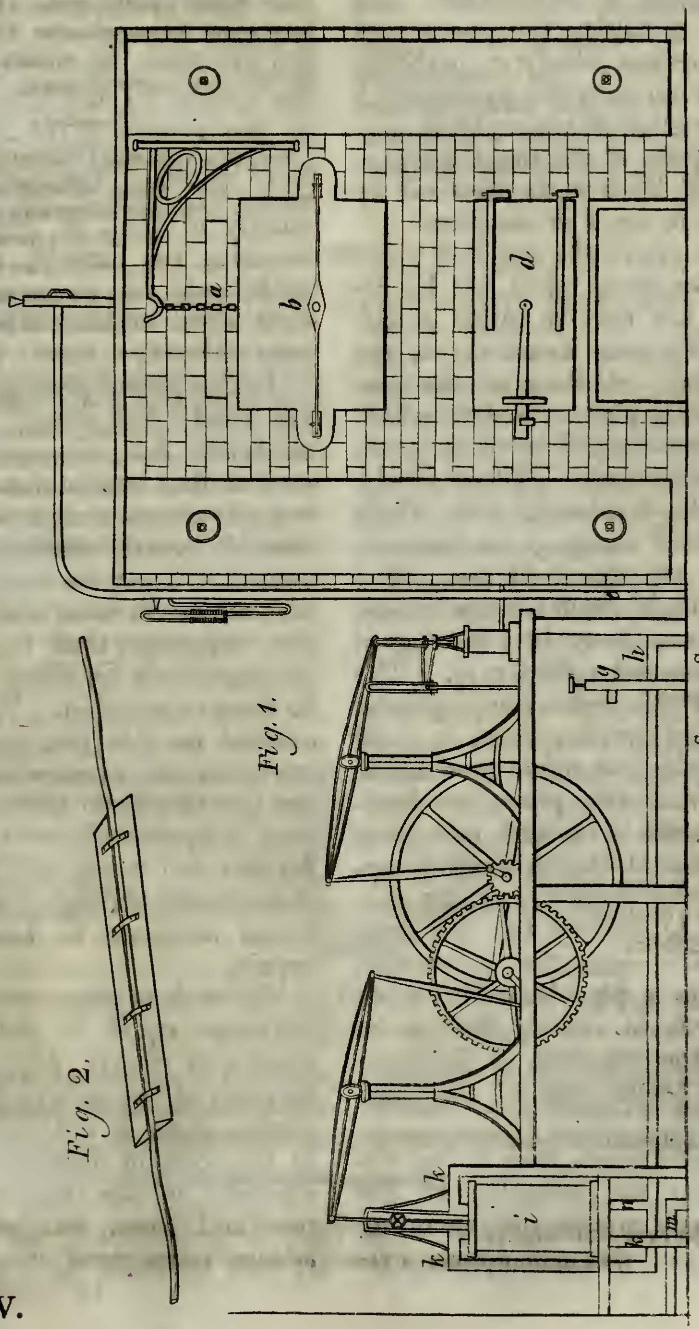

Fig. 1.

Fig. 2.

MR. BROADMEADOW'S PATENT PROCESS FOR GENERATING AND PURIFYING GAS.

This patent process consists, 1st, In substituting brick ovens for iron retorts; 2dly, In exhausting the ovens of the gas, as fast as generated, by the application of an exhausting cylinder, constructed somewhat similar to the blast cylinders used in iron works, or by any other means of exhaustion; and 3dly, In purifying the gas so generated, either wholly or partially, by admitting into the gasometer a certain portion of atmospheric air.

One mode of effecting these purposes will be fully understood by reference to fig. 1 of the plate.

a is an oven; the size and number of the ovens need not be restricted, but may be varied as circumstances may demand. *b*, the oven door. *d*, door of the fire-grate. *e*, a pipe, through which the gas is conveyed from the oven to the condenser. Close to the pipe is the condenser, into which a small hand pump, *g*, is inserted, to draw off the coal tar. *h*, a pipe, through which the gas passes from the condenser into the top of the exhausting cylinder, *i*. The piston of this exhausting cylinder receives its motion from a small steam engine, or other mechanical power. *k*, *k*, two pipes, one leading from the top, and one from the bottom of the exhausting cylinder to the purifier. *m*, an outlet pipe, to convey the gas from the purifier into the gasometer. And *n* is a pipe branching from the pipe *h*, to convey the gas at the alternate vibration of the beam into the lower part of the same cylinder.

The advantages said to be derived from the adoption of the above patent process for generating and purifying gas, will appear evident from the following circumstances.

In the erection of works on the ordinary plan, one of the principal items of charge is that for iron retorts, together with the hydraulic main, and other necessary connections; and in conducting works on the same principle, an enormous expense is annually incurred by the oxydizing or burning away of the retorts. Indeed, the oxydation of the retorts is so rapid, that, however the time of their duration may vary, from a difference in the quality of iron, or mode of constructing the furnace, they cannot withstand, on an average, more than eight or nine month's exposure to the fire.

In this patent process, no retorts are used; but ovens, constructed of brick, &c. Consequently, the cost of first erection, and the subsequent annual charge for tear and wear is greatly diminished. The ovens, it must be confessed, are also subject to tear and wear; but the expenses thus incurred are, comparatively speaking, too trivial to deserve mention. For at works erected on this principle at Abergavenny, an oven which has for the last two years been in constant use, is apparently none the worse for tear and wear; and a less sum than twenty shillings per annum is found adequate to keep them in repair.

As each of these ovens contain a charge equal to about six full sized iron retorts, and requires to be charged but once in twenty-four hours, there is not only a saving in the cost of first erection, and annually in the expenditure for tear and wear, but also in the labour consequent upon the old process; in which much of time as well as labour is usually expended in the draining of the charges, and in the recharging.

The next improvement, and which has been already stated as one of the principal features in Mr. Broadmeadow's process, is, that of his application of an exhausting cylinder, or other apparatus, to exhaust the gas from the condenser, thereby causing a partial vacuum, and enabling the gas to flow from the ovens into the condenser as fast as it is generated. By means of this exhausting cylinder, a portion of atmospheric air, equal to about one-eighth part of the entire quantity of gas is admitted into the gasometer; which process, however contrary it may appear to those practised in the common modes of gas making, is decidedly beneficial. For the oxygen of the atmosphere mixing with the sulphuretted hydrogen, precipitates the sulphur, and gives to the lighted gas a much greater degree of brilliancy. This mode of purifying is indeed so efficient, that when the coal used is of good quality, no other purifying is required, as the admission of too great a portion of atmospheric air would prove injurious; the requisite speed at which the exhauster should be worked, is shown by a water-gauge.

MOVEABLE BRIDGE TO BE USED AT FIRES.

GENTLEMEN,—On the night that the premises of the Messrs. Reid were destroyed by fire, I observed that several of the water pipes, from the plugs in the pavement, crossed the street to the fire-engines, and before any of the carts with the water-butts could pass, the pipe had to be detached from the engine; thus cutting off the supply of water when it might be doing the greatest service. A thought occurred to me at the time, that two pieces of wood, about two and a half inches thick, and six inches broad, tapered to a wedge-like form, as per sketch, (see fig. 2,) might be attached to each other with iron straps, leaving a space betwixt them equal to the diameter of the water pipe, and about seven feet long, thus forming a small moveable bridge. One of these might be hooked on to every fire-engine, and could be laid over the pipe, and a man with a torch, (if the fire occurred in the dark,) might be stationed to direct the carts over that place; and they would thus have it in their power to pass and repass without the necessity of moving or damaging the pipes.—If you think this worthy a place in your useful Magazine, insert it, and oblige, yours, &c.

Glasgow, 6th Dec. 1825. J. W.

SELF-ACTING COTTON MULES.

[From the Manchester Advertiser.]

MANY of our readers are probably already aware, that within a few months past, two patents have been taken out in this neighbourhood, for self-acting mules for spinning cotton; one by Mr. Roberts, of this town; and the other by Mr. De Iongh, of Warrington; both of which, by a singular coincidence, were granted on the same day.

We understand that the one invented by Mr. De Iongh is now at work, and we have been told that it spins well, but have not yet had an opportunity of seeing it. We have, however, had several opportunities, during the last week, of observing that invented by Mr. Roberts, and we have to announce its complete success—a success, indeed, so decisive, as to astonish even those who were best acquainted with the extraordinary talents of the inventor, and who consequently formed the highest expectations as to the result of his labours. Though the machine is, to a certain extent, rude and temporary in its construction, and has been set to work under several disadvantages, it is now spinning as well as, if not better, than a hand-spinner could possibly do.

The mule to which Mr. Roberts' invention is attached, is one of 120 spindles, and quite new, having never been worked upon before, and consequently not so well adapted for the purpose as one that has been a short time in use. It has been set to work in a room of very unequal temperature, (being heated merely by pans of charcoal,) and with rovings in very indifferent condition; but yet, as soon as the different movements were properly adjusted, it spun nineteen stretches (of 40's twist) without breaking a single end, and it now generally spins for half an hour together, without breaking an end in running in the carriage, which is the best criterion for judging of the merits of the invention; the breaking, in coming out, being referable to causes entirely unconnected with Mr. Roberts' patent. Indeed, it is perfectly obvious, from an examination of that part of the machine by which the difficult process of winding-on is effected, that it must possess very great and decided advantages over the hand-spinner. By a contrivance, equally simple and efficacious, the tension of the yarn in winding-on is always precisely the same, whether it is wound upon a bare spindle or a full cop; so that the cop must be throughout of an equal degree of hardness; and the tension may, with the greatest ease, be varied to any point which is requisite for spinning the finest or the coarsest yarn, or for producing the hardest or the softest cop. On this account the invention is extremely well calculated for spinning fine numbers in which the moderate and equal tension of the yarn in winding-on is of the utmost consequence; and we should not be at all surprised if it is made to produce yarn of a degree of fineness which has never yet been, and never can be, spun by hand.

In another point, too, Mr. Roberts' invention possesses a decided advantage over the mule in common use, and an advantage which would scarcely be expected from it, *viz.* a considerable saving in time. In other investments of this nature, for which patents have been obtained, the reverse has been the case—there has been a great loss of time in putting up the carriage; and this is one of the objections which have prevented their getting into general use. In Mr. Roberts' mule the various motions follow each other with as much rapidity, and may be made to proceed with as much velocity as the yarn is capable of bearing; so that there is no loss of time in any part of the operation. So far as we can judge, all the parts of the machine are capable of ready adjustment, and not liable to get out of repair, which in a machine that must be entrusted to the management of persons of moderate mechanical skill, is a matter of no small consequence.

It may probably be supposed, that a machine so effective must, of necessity, be complicated and expensive in its construction, but this is by no means the case: it is, comparatively, a very simple machine. It is, perhaps, necessary here to explain, that Mr. Roberts' improvements are confined (with very trifling exceptions) to that part of the mule which is commonly called the *head-stock.* In the rollers, the spindles, and the body of the mule generally, there is no alteration whatever; and we should suppose, that one of Mr. Roberts' head-stocks would cost little more than one of those in common use; so that where parties are getting new machinery, the difference of cost per 100 spindles would be a mere trifle. But the invention is also already applicable to old mules on the common construction; in which case it will only be necessary to remove the old head-stocks, and replace them by new ones on Mr. Roberts' plan, which may be done in about the same time that would be necessary to change one of the old head-stocks for another.

Mr. Roberts' invention possesses various other advantages of minor importance, which, however, are still worth mentioning. The alteration in the head-stock necessary for changing the count of the yarn, is effected in a very simple and expeditious manner: the head-stock itself does not extend beyond the rollers, so that when placed in the centre of the mule, it does not obstruct the view or the passage along the wheel-house—there will also be a considerable saving in shafting a mill intended for these mules, as no cross-shafts will be necessary for driving them.

We intended to describe the construction of this important machine, which, we have very little doubt, is destined to work a complete revolution in the mode of spinning cotton; but we find that some engravings are necessary to make our description intelligible. We are, therefore, under the necessity of postponing our description for a week or two, that we may have time to get them executed.

ON THE DEATH-WATCH.

Gentlemen,—I was curious to ascertain whether that singular insect, the "*termes pulsatorium,*" ("death-watch" of the vulgar,) has any stated intervals between the beats, or any ratio of number in the pulses. On the night of the 18th August, 1822, at 11 o'clock, p. m., I had an opportunity of ascertaining this question, in which I used a stop-watch to determine the periods.

119 beats... 9	seconds of	interval.
88 16	do.	do.
96 14	do.	do.
147 11	do.	do.
76 12	do.	do.
167 14	do.	do.
133 12	do.	do.

So there appears to be no specific or determinate ratio, nor any chronometric regularity.

Yours, &c.

J. M.

Paisley, 6th Dec. 1825.

"CICADA SPRUNARIA."

Gentlemen,—That curious insect, a species of grasshopper, the *Cicada Sprunaria,* which inhabits the froth pendant on leaves, twigs, &c. during summer, called "cuckoo spit," appears to be the *larvæ* of this insect. For what purpose this curious envellope is provided, it is difficult to determine. I have found two of the larvæ in one frothy covert. Some naturalists have supposed that this was merely the medium of concealment from its enemies, as, for instance, the *aranea* and *phalangium*. This is unsatisfactory; certain it is, that it proves fatal to some winged insects, and I have seen dead *tipulæ*, &c. thus ensnared.

My opinion is, that it serves to sustain a uniform temperature: the reduction on evaporation would equalize the medium, which would always be in the ratio of the action of the sun-beams, &c. and I think the following experiments tolerably conclusive: 4th June, 1823, at half-past 5, p. m.—air, 54° Fah.; temperature of froth, 50°; air, 56°; froth, 52°; and by evaporation, when applied to the ball of the thermometer, 47°.5; air, 52°; evaporation by rain water, 43°.—air, 49°.5; froth, 46°; by evaporation, 43°.5.

When in the sunshine, and placed on a leaf, it leaves a slimy film of a leaden hue. The mucus seems to exude from the anus, and abdominal annulæ, and continually to diffuse and invest the insect. When the insect is removed from its envellope, the mucus, after some time, becomes more viscid, and springs like Indian weed, as it appears when seen through a lens, sometimes entangling the insect as it moves. The form of the frothy case will be found, if I mistake not, to vary with the density of the air. Before rain, and when the atmosphere is attenuated in density, the bag or globule will be found elongated and pendulous. During rainy weather, I believe, the "cuckoo spit" almost disappears.

Yours, &c. J. M.

10th December, 1825.

ON THE DISEASES INCIDENT TO MECHANICS.

By a Physician.

On the Diseases of Printers—continued.

With a view of preventing the constant exertion of the eyes being productive of the diseases I pointed out, as incident to these organs in printers, the use of spectacles is the only means I have known recommended by physicians. I am, however, far from convinced of the value of these as a *preventative*, and would, for reasons unnecessary to detail here, advise their use to those only whose vision was already weak and deficient. It occurs to me, and I would suggest it as worthy of experiment, that the painting the frame, &c., in which they keep their types, of a green colour, would prove a more grateful and less irritating object than the black aspect it usually presents; besides, the apartment could be at a very cheap rate made of a pea-green colour, which I am quite sure would be a vast relief to the eye, and prevent the bad effects arising from irritation of these organs. In those cases where no decided symptoms of disease had come on in the eyes, the frequent bathing of them with cold water would soothe them, especially after long exercise, and tend to invigorate the sense of vision.

Since this class are not solely, and by no means so often, subject to the colic mentioned in our last communication, as the painters are, we shall defer a consideration of its remedial treatment, and merely recommend, as a preventative, the avoiding to put the types into the mouth, washing the hands before meals and on leaving off work. Rubbing a little olive oil on the hands, morning and evening, has also been recommended. The tumid feet and ankles, with the enlarged veins and ulcers not unfrequently attendant thereon, will be prevented by the use of what is called a laced stocking, or a properly applied bandage. The diseases arising from a want of exercise, are best prevented by sobriety and regularity of life. And by printers every opportunity, consistent with their business, should be taken to enjoy exercise in the open air—means of procuring health and comfort, too often neglected by many orders of mechanics for scenes of intemperate indulgence. The badly ventilated and unhealthy situations too often selected for printing establishments, is a subject on which I might justly animadvert, were I likely to overcome prejudices and self-interest, such formidable opponents to improvements in this matter. I must add, however, on the whole, that in those points of view there is infinitely less room for censure in this city than in other places I have visited.

I would most gladly describe the mode of applying proper dressings and bandages to the ulcers occurring on the legs of the workmen of this and of other trades, but I much doubt if any account I could give would enable them to do it in a manner practice can alone effect. I would, however, recommend an early attention to all sores on the lower extremities. In their early states, surgical aid will in general effect a cure, but when once there is much destruction of parts, the difficulties of cure are great—nay, impossible—and the sufferings of the patient most distressing.

The diseases arising from exposure and intemperance, we have already noticed. The preventatives are indeed obvious; and I earnestly wish the practice of them may be scrupulously attended to, as their success would certainly lead to the health, comfort, and longevity of a class whose occupations are so essential to the general weal, and in themselves so creditable.

INDIAN RUBBER TUBES.

At a meeting of the Nottingham Literary and Scientific Society, held on Monday, the 10th instant, a paper by Mr. H. B. Leeson, describing an improved process of manufacturing Tubes and other Articles from Indian rubber, was read, and some tubes so prepared were handed round for the inspection of the members.

After pointing out, that all the present processes of manufacturing elastic gum were objectionable, either from the injury they occasion to its elastic properties, or the great expense of the menstrua employed, (such, for instance, as cajeput oil and ether,) the writer proceeded to detail his process.

A bottle of Indian rubber, previously softened by boiling in water, as described by Mr. Leeson, in his paper on the self-acting blow-pipe, inserted in the 17th volume of the Quarterly Journal of Science and Arts, is first to be distended to the utmost possible extent, by means of a condensing syringe. The rubber thus expanded into a uniformly thin layer, is then cut into stripes of the breadth of one or two inches, and wrapped longitudinally round polished iron rods, of the same diameter as the bore of the tubes required. The rod has a hole through each end, and a tape being made fast to one hole, it is tightly wrapped, in a spiral manner, over the layer of elastic gum previously applied. The whole is then boiled in water for several hours; and if, when taken out, perfect adhesion has not taken place, it is again wrapped with fresh dry tape, and reboiled until the union is complete. The roughness left upon the external surface of the tube may afterwards be removed, by binding it with a smooth plate of metal, and boiling it over again. The tubes exhibited to the society were in nowise to be distinguished, in their elasticity, from the bottles met with in commerce, and afforded convincing evidence of the excellence of the process.

ON THE PREVENTION AND CURE OF THE DRY ROT.

By Mr. John Hart, Glasgow.

Gentlemen,—A late Number of your useful Magazine contains the following query: "What is the best means of preventing or curing the dry rot?" The insertion of the following from the Monthly Magazine, will be an answer to that query; and, at the same time, it may be useful to some of your readers, who may not have an opportunity of seeing that work.

"*To the Editor of the Monthly Magazine.*

"Sir,—The attempts to cure the dry rot have been so numerous, and the subject has so often engaged the attention of the public, that some apology may be necessary for occupying your valuable pages with the following specific, and the more so, as I believe that it has appeared in another periodical work; but the length of time since that took place is so great, and the circulation of your Miscellany is so much more extensive, that I am induced, thinking I am conferring a public benefit, to forward it to you.

"The greatest care must be taken to remove every fibre of the fungus, and to clear the whole of it away, even from the walls of the building; and previous to putting in new timber, the joists, if for a ground floor, and the back of any wainscot that may be used, should be washed with green copperas, melted in the manner directed below, giving it two coats, which will easily adhere, and soon cool, if the timber be dry; then strew the ground with iron scales from the blacksmith's forge, which will destroy the vegetable fungus, and any sea-weed appearance, which attacks new timber much sooner than old.

"Twenty years' proof of the efficacy of the above process, in the residence of a worthy friend at Clapton, Middlesex, whose dining and drawing-room floors had been twice relaid in the short space of six years, is a sufficient recommendation; and it only requires to be known to be resorted to, when buildings are suffering from that most destructive of all enemies—the dry rot.

"The use of iron scales, which were thickly strewed on the ground before laying the joists of a house, built sixteen years since, in a damp situation, has preserved the building from dry rot; no symptoms having made their appearance.

"To melt green copperas (which is very cheap) use an iron pot, as for pitch, putting in a little water to assist in dissolving it, keeping it stirred with a stick, to prevent its adherence to the pot—the copperas to be used as soon as melted.

"Yours, &c.

"James G. Tatem.

"Wycombe, 17th October, 1825."

In confirmation of the above, about a twelvemonth since, we had to remove the ground floors of a property that was destroyed by dry rot. Previous to laying down the new floors, we were advised to clean them properly, ventilate them well, and to wash over the wood and bottom of the walls with a solution of copperas, or to give them a coat of coal tar. The first we preferred, as having no offensive smell. No vestige of the disease has made its appearance since. To ascertain the nature of this disease, and the efficacy of the remedy we had adopted, we took several pieces of the old floor, and with hot water having carefully washed off the fungus, placed them in a confined, warm, and moist situation: in a few days a new crop made its appearance; we then washed part of them over with a solution of copperas, and allowed them to remain a few days longer. Where the copperas had touched, the fungus became shrivelled, and disappeared, while the rest continued to grow vigorously. We likewise threw some pieces into an oven, and allowed them to remain till the outside of the wood became slightly brown, and the rosin was boiling profusely out of the knots, the tainted places became black, and the parts much affected completely chared, and in some places caught fire; still, when these pieces were placed in a favourable situation, the fungus again made its appearance, but the parts moistened by the solution remained quite destitute of any vegetation whatever.

It may here be proper to caution your readers from using any tainted wood of this kind, or even keeping it among other wood in damp situations, as it will affect the surrounding wood and even the walls. Thus the willow hoops of a barrel, standing about a foot distant, became infected and spotted with a fine down; and a block of planetree, on which some of the deals were laid, soon became covered with fungus; a barrel that had been well painted, being afterwards left in the situation where the experiment was made, (after all the wood was removed,) began to show signs of it likewise between the seams of the staves where the paint had cracked. A wooden frame of a machine became likewise infected, but by washing it over with copperas water, its farther progress was instantly arrested.

The solution used by us was made by dissolving the copperas in warm water, about the temperature of 80° or 90°, always giving more copperas than the water could dissolve.

Yours, &c.

JOHN HART.

Glasgow, 11th Dec. 1825.

ON THE CULTIVATION OF THE SILK WORM.*

THE cultivation of the silk worm is an abundant source of wealth for Italy, and many of the southern departments of France. It is certainly not unworthy of remark, that so little has been done to introduce this valuable insect into this country; and the author of this pamphlet is entitled to much praise for the endeavours he has made to bring it into notice. So far back as the reign of James the First of England, a royal edict was issued recommending its cultivation, besides other means used for promoting this branch of national industry by the issue of packets of mulberry seeds, &c.; and a patent was granted to John Appletree, Esq., under the great seal, dated the 23d May, 1718, for the planting of mulberry trees, the erection of buildings, and the culture of the silk worm.—Hitherto, however, literally nothing has been done; and it is with many more than problematical, whether the silk worm can be cultivated in this country at all. We do not doubt, however, that were the attempt fairly made, this insect may be naturalized here; and that we may yet obtain a brood sufficiently hardy to bear the inclemency of our climate. Great Britain differs not more in temperature from Italy and the south of France, than these do from the oriental climes whence the silk worm first sprung, and where it is indigenous. It is a general belief at Paris, we believe, that it is impossible to cultivate the silk worm successfully even there; but M. des Longchamps has lately succeeded in several experiments made by him, and he states it as his conviction, that the failure of his predecessors has been owing to their want of knowledge on the subject. A very productive culture of silk worms is made much farther to the north in Germany; and it is even said, that, twelve or fifteen years ago, Marshall Bribentein, author of the Flora Caucasus, introduced the culture of the white mulberry tree, and the education of silk worms, into several districts of the Ukraine, as far as the 50th degree of north latitude. These have succeeded so well, that there are already several silk manufactories in those countries, which are in a rapidly progressing state of prosperity. Why then should we doubt the possibility of the silk worm being naturalized in Great Britain?

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* Remarks on the Cultivation of the Silk Worm, with additional Observations made in Italy, during the Summer of 1825. By John Murray, F. S. A., F. L. S., &c. &c.—Glasgow, W. R. M'Phun. London, Knight & Lacey, 1825.

"The silk worm (says Mr. Murray) appears to be a native of China, and feeds on the leaves of the mulberry; and I found every where in Italy, a decided preference given to the white mulberry. The Chinese seem to have been acquainted with the culture and manufacture of silk from a very remote period. But it was scarcely known in Europe before the age of Augustus. This beautiful substance soon attracted the notice of the luxurious Romans,—and became a common article of dress after the effeminate reign of Eleogabulus. It was brought from China at a very considerable expense; and, after being manufactured by the Phenicians, was sold at Rome for its *weight in gold.* By the conquests of the Scythians, this commerce was interrupted in the reign of Justinian; and all attempts to restore it failed, till two Persian monks, bribed for this purpose, concealing the eggs of the silk worm in hollow canes, brought them from China to Constantinople, where they were carefully propagated. This was in 555, and we find some years afterwards, that the Greeks had learned the art of cultivating and manufacturing it. Roger, King of Sicily, introduced the manufacture of silk into that kingdom, about the year 1130, by forcibly carrying off the silk weavers from Greece to Sicily. From thence the art of cultivating and managing the silk passed into Italy, afterwards into France, and, on the revocation of the edict of Nantz, a manufactory was established in Great Britain.

"The insect, from which silk is procured, reposes motionless for the period of nearly six months, in a minute round body, called the *ovum,* or egg. From thence it springs, under the form of a little elongated animal with eight pairs of feet, a caterpillar, or *larva.* This caterpillar, improperly called silk worm, feeds on the leaves of the mulberry. It increases rapidly in size; so much so, that its skin in six or seven days after birth cannot contain the internal organs. In its turn this skin bursts,—and the little insect comes forth in a new dress, advancing towards another stage of maturity for seven days more. There are altogether, under this state of being, four distinct changes of skin. When the silk-worm feels that it is about to quit its *fifth* skin, it looks out for a secure and retired situation, and there constructs a dormitory, where it may be safe from external contingencies. It then spins its silken web, disposing it in such a manner as to leave an oval cavity within. This ball is called the *cocoon.* The larva casts off its last skin in this abode, to become a being of another order, and altogether different from the appearance it had before assumed. In this singular form, in which it somewhat resembles a child in swaddling bands, it is called *crysallis aurelia,* or *nympha.* In twenty days after the transformation of the larva, or caterpillar, into the crysallis or aurelia, entirely effected within the cavity of the silken cocoon, we may perceive, at length, a little insect, plumed with white wings, burst from the cocoon. This is the *imago*, or winged state of the animal, called phalena, or moth—the most perfect state of this strange microcosm. The moth soon lays eggs; these (about six months after) in their turn, again produce larva. This larva spins the cocoon, and the same interesting circle of changes is thus repeated."

Mr. Murray's object in this pamphlet is, to extend a knowledge of Count Dandolo's method of cultivating the silk worm; and there can indeed be no question, that whether they can be naturalized here or not, they can be profitably cultivated on these principles. This method is to cultivate them by means of artificial heat, in the same manner as we cultivate exotics in a hot-house. It has been adopted in Italy, and there has, we believe, proved universally successful. The process is, by this means, reduced to absolute certainty; and the blast of the Schirroco, which was wont frequently to destroy the hope and promise of a whole year, is now rendered innoxious. The average return is, besides, much increased; and even successional crops can be obtained. M. des Longchamps, whom we have already mentioned, has made repeated experiments on this subject. He observed that the hatching of the silk worm took place naturally a month or six weeks later in Paris than in the southern departments of France; and he was thence led to conclude, that this protracted development in the north was owing to the more vigorous temperature and longer duration of the winter. It seemed, therefore, probable, that by putting, towards the end of the winter, silk worms' eggs in a place where the temperature should remain fixed at a certain degree, and where light should be excluded, it might be possible to retard their development, so that they might be allowed to come to perfection only when desired, by removing them from the cool place in which they had been kept, and making them pass successively through the intermediate degrees till they gradually reached the temperature usual in the month of June, July, and August. By this simple means, many crops might be obtained in the course of the year. We have not room to give here a detail of the various experiments entered upon by M. des Longchamps, for the purpose of trying his hypothesis, an account of which he has presented in his memoir to the Academy of Sciences; but must content ourselves with stating, that these experiments sufficiently prove the probability of having several crops of silk in the year, and agree with what is said to take place in India, where, we are told, there are as many as twelve crops of silk gathered in the year.

We agree with Mr. Murray in thinking, that the cultivation of the silk worm, on the principles of Count Dandolo, would prove a most profitable addendum to the poor-house in Britain; and that the aged, and even the infirm might find here occupation of healthful interest to themselves, and relief to the burdened benevolence which supports them. Its general introduction would unquestionably prove a new and extensive source of national wealth and industry. We hope that ere long this will be the case; and we look forward with some hope to the exertions of a most respectable Society, having the Duke of York and the Earl of Liverpool at its head, the avowed object of which is, to introduce the silk manufacture more generally in this country, and to produce the raw material. To those taking an interest in the improvement of this branch of national industry, Mr. Murray's pamphlet will be found to contain much useful information; but as the following general remarks on rearing the silk worm, will be interesting to the general reader, we cannot refrain from extracting them.

"The eggs are first strewed on shallow trays of paper, of a convenient size. Brown paper on white laid wire paper is decidedly the best, since that which has undergone the destructive process of *bleaching* might prove injurious, if not fatal. The mulberry leaves, (those of the *white* mulberry are by far preferable,) are at first chopped small, in the quantity already described, and strewed over the trays. The caterpillar is, in its second or third, &c. stage, transferred to larger and more commodious trays, and an increased supply of food given, proportioned to their size. At first, the compartment is small, then the caterpillar is removed to a room of a larger size; while the heat, at first about 72° F. gradually declines to 69°.

"The cocoons, when intended for silk, are thrown into boiling water, to destroy the included *nympha*, and then carefully dried by a stove heat, or in an oven. Those intended for the future crop are strewed over a coarse linen cloth, extended on a table in an unused room. It is stated that an *obscure* or darkened room is best adapted for this purpose; and the habits of the family of the *Phalenæ* seem to sanction the conclusion.

"The female *nymphæ* weigh about twice as much as the males, and thus the female, all circumstances being alike, ought to be larger than the male cocoons. The other modes of discrimination are equivocal or fallacious, and even this test is only to be considered as a general guide or approximation to truth. 100 males weigh 1,700 grains, and 100 females 3,000 grains. A proper number of each being selected, the cocoons intended for the production of the moths are placed on the cloth, (as before-mentioned,) in a room, the temperature of which does not exceed 72° F.—a higher temperature, though it might cause their earlier evolution, would injure their healthiness, and if the principles of the Count are adhered to, the cocoons will be always healthy. Stillness and decreased light will be found favourable circumstances. The moths having deposited their eggs on the coarse cloth prepared for this purpose, soon die; the ova adhere by a gummy matter to the cloth. The temperature is reduced to about 66° F. and when the ova, after remaining a few days, have acquired an *ash colour*, the cloth extended on a frame may thus be removed to a cool apartment, where it is necessary they should be preserved *dry*. The eggs when required are easily detached by immersing the cloth in fresh water, which dissolves the mucilage, and they are then carefully and properly dried.

"The obtainment of the silk from the cocoons, consist in collecting the various threads, winding them on reels, taking care that the cocoon severally unwind freely through all their extent. In order the more easily to obtain this end, the cocoons are thrown into caldrons containing water heated to nearly the point of boiling. The various threads are then collected together by means of a whisk or brush, and are thus attached to a reel, passing through plates of steel, &c. being wound by particular machinery attached to a water-wheel. When the water is pure, and the more it is preserved clean in the boiler, so much the more beautiful and abundant is the product, because the water otherwise becomes discoloured, from the decomposition of the crysallidæ that fall to the bottom.

"In the month of August last, at Buffalora, on the Milanese frontier, I visited an establishment for unwinding the silk. Women were arranged in two rooms, opposite each other, and conducted the process. The cocoons contained in baskets on one side were thrown by handfuls into caldrons of water, kept boiling by charcoal fires beneath. Each by a *whisk* (of peeled birch) collected the threads *en masse*, the first confused portions were rejected, till the threads unwound regularly, freely passing over glass-rods to prevent the injuries of friction. The first portions are necessarily useless, and are separated by the hand. When the threads came off uniformly, the cocoons were raised suspended to the hand by their respective threads, and thus handed over to those on the opposite side, who, in their turn, threw them into caldrons of water, tho temperature of which was nearly that of blood heat, and more than milk warm—thus sustained by a steam pipe. The water was thus kept clear, and the silk preserved pure and unsoiled. From these the threads were finally wound. The proprietor informed me that this establishment cost 60,000 francs."

ON THE LEECH.

Gentlemen,—The *Hirudo Medicinalis*, or Leech, presents in its physiology many curious features interesting to the naturalist, and one entire volume, at least, has been expended on the subject. It is not my intention to touch on its natural history, or even the curious meteorological phenomena connected with its position and movements. I shall content myself at present with some experiments of a very simple kind in relation to its preservation for medical use. The notes I made at the moment are before me, and may suggest a useful hint. I may premise by stating, that when a frog was thrown into a vessel containing leeches, as if aware of its situation, it tried hard to escape; but the blood-thirsty leeches took sufficient care that it should not. It was prevented from getting its head above water, and thus suspended in the liquid medium. Many of the leeches fastening themselves at the bottom of the vessel made this their fulcrum or purchase, and by the other end adhering as firmly to the struggling frog, soon emptied its veins of the vital gore.

Six French leeches were, on 17th Oct. 1822, put into 6 fluid ounces of distilled water, corked and tied up with bladder, quite air tight. On the 24th of same month, $4\frac{3}{4}$ fluid ounces of the water was treated with lime-water. Some of the interspersed mucus matter became milky, it was hence inferred that this enveloped carbonic acid gas. By agitation a part collected. $4\frac{3}{4}$ fluid ounces were filtered. Filter weighed before the experiment, 16.50 grains, and afterwards 16.75 grains $= \frac{3}{8}$ grain carbonate of lime, and which contained .22 gr. carbonic acid gas. The matter on the filter was ferrugenous or ochry-like from the action, as I inferred, of the lime on the mucus.

Hence the leech, an equatic animal, respires, like land animals, carbonic acid gas. At the close of the experiments, the leeches were most lively and vigorous, and so far from suffering from their close imprisonment and their medium of distilled water, seemed rather much improved.—Your's, &c.

J. M.

Paisley, 6th Dec. 1825.

FRENCH MECHANICS' INSTITUTIONS.

At the last sitting of the French Institute, M. Dupin, presenting his course of Geometry and Mechanics, combated the opinion of those who imagine that the knowledge of geometry is only necessary for the construction of machinery. He stated that upwards of 150 arts and trades would derive great advantage from the artizans being instructed in that science. M. Dupin took a glance at the relative state of industry in France and England, and was forced to acknowledge the great inferiority of France; and cited, as a proof, the stagnation of French commerce and manufactures compared with the "prodigious augmentation of the commerce of England. It is not," said he, "that we have gone back, but England has made an infinitely more rapid progress." He added, that it was only in the mechanical arts that England excelled. For example, chemistry in France is far from being behind that of any other nation. The Berthollets and Fourcroys had persuaded the Government to found establishments for facilitating its progress. It will be the same with the mechanical arts, if analogous establishments are encouraged. Already the schools formed in different towns of France, and the lectures given in them, give the brightest hopes.

REVIEW OF DR. THOMSON ON THE ATOMIC THEORY.

[From the London Journal of Science.]

(Continued from page 269 of the present Volume.)

Chapter Sixth is occupied with the atomic weight of the acidifiable combustibles, carbon, boron, silicon, phosphorus, sulphur, selenium, arsenic, and tellurium.

The Doctor exposes calcareous spar to ignition in a platinum crucible, and gets at once, as if by a wishing-cap, the absolute atomic weight of carbonic acid. "The next object," says he, "which engaged my attention was to disengage the carbonic acid from 100 grains of calcareous spar, and to collect it over mercury, in order to ascertain its volume."* The manner in which he tries to attain his purpose, would insure its failure in any hands but those of Fortunatus. He treats 100 grains of calcareous spar with strong nitric acid in a retort, connected with a graduated glass receiver nearly filled with mercury, and inverted in a basin of that liquid. The beak of the retort has a stop-cock attached to it, from which a bent glass tube proceeds to the top of the receiver. The spar in three or four pieces is dropped into the tubulure of the retort; its stopper is inserted with all convenient speed, and the stop-cock opened. We, who have made many similar experiments, know well that so much carbonic acid gas would escape in the time of introducing the spar and closing the retort, and so much nitric acid vapour pass over with the gas into the receiver, as would render the experiment nugatory for all atomic determinations. It, moreover, occasions too many chemical computations for the Doctor's arithmetic. On this occasion, he acts with a prudent reserve. He takes care not to state the experimental quantities, but pronounces the following oracular response. "All the necessary reductions being made, the volume of carbonic acid gas evolved from 100 grains of calcareous spar, supposing the barometer to stand at 30 inches, and the thermometer at 60°, and the gas to be perfectly dry, amounts from a mean of two experiments, *both made with very great care*, to 94.246 inches."* The Doctor has already drawn so freely on our credulity, that we have really none to spare for the present large demand. The result is plainly factitious.

We cannot bestow a thought on his *luminous* details *about* the compounds of carbon and hydrogen. In a paper published in the Phil. Trans. for 1822, there are some facts relative to naphthaline, which he has carefully concealed from the readers of his book, lest, by stating prior researches, he should stultify his own.

Under silicon, he furnishes an amusing example of the facility with which mineral analyses may be twisted into any shape that a theorist shall fancy. Thus, of nepheline, he says, "Let us suppose that in this mineral, every atom of alumina is combined with an atom of silica; and every atom of soda with an atom and a half of silica." Again under dioptase, "Let us calculate the constituents of this mineral on the supposition that it is a hydrated sesquisilicate of copper." Knebelite consists, according to him, of silicate of iron, silicate of manganese, and *trisilicate* of manganese.

How imperfectly the Doctor is acquainted with the chemical habitudes of saline bodies, on which their mutual decompositions depend, will appear from his employing sulphate of soda as a re-agent to detect the presence of lead. He mixes solutions of phosphate of soda and nitrate of lead, and tries the supernatant liquid, after it has become limpid, as follows: "A drop of this liquid was put into a watch-glass, and mixed with a drop of solution of sulphate of soda. No precipitation or opalescence took place, showing that the liquid contained no sensible quantity of lead."*

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* Thomson's Attempt, i. 140.

* Thomson's Attempt, i. 143.

We affirm on the contrary, that a solution may contain a very sensible quantity of lead, though sulphate of soda does not occasion in it either opalescence or precipitation; a fact which we shall state in detail presently.

Dr. Thomson gets completely bewildered in his Seventh Chapter, on the relation between the atomic weights and specific gravities of gaseous bodies. Here we find him describing an arbitrary convention of numbers, as a law of chemical combination. The law is thus enunciated: "The specific gravity is equal to the atomic weight multiplied by half the specific gravity of oxygen gas."†

This is a valuable piece of legislation. Dr. Thomson resolves that half a volume of oxygen, weighing 0.5555, when air = 1, shall be regarded as the atomic unity, or 1: consequently, the atoms of all gaseous bodies may be represented numerically in reference either to that demi-volume 0.5555, or to the weight = 1. Hence the reduction of weights to volumes or specific gravities, is done by multiplying by 0.5555. This instead of being a law of chemical combination, is an annoyance created by the present oxygen scale, from which the hydrogen scheme is free. But this matter has been already discussed. Yet, after all, Dr. Thomson is under a mistake in ascribing to Dr. Prout the merit of that rule for converting the atomic weight of a body into the weight of its volume in the gaseous state. It was clearly stated by M. Guy Lussac, in his memoir on iodine, first published in 1814, and translated by Dr. Thomson into his Annals for Febuary 1815. We there read, "We do not know the density of the vapour of iodine; but from experiments to be stated below, I have found that the ratio of oxygen to iodine is 1 to 15.621. Now the density of a demi-volume of oxygen being 0.55179, 0.55179 × 15.621 = 8.6195 will represent the density of iodine under the volume taken for unity."*

Under alkalies and akaline earths, we can perceive no new determination of any consequence.

The section on alumina exhibits the atomic theory, dancing in masquerade among the mineral species. Thus, after stating Rose's analysis of felspar, he proceeds as follows: "Let us suppose that all the bases are combined with silica, and in the state of trisilicates, except potash, which is a quadro-silicate; and let us calculate its constitution according to that supposition.

(1) 2.25 : 6 : : 17.5 : 46.666 = silica united to alumina,
(2) 6 : 8 : : 12 : 16 = silica united to potash.
(3) 3.5 : 6 : : 1.25 : 2.143 = silica united to lime.
(4) 4.5 : 6 : : 0.75 : 1 = silica united to oxide of iron."†

In spite of all this coaxing, he is pestered with an excess of silica in the mineral = 0.941, with which his four bases will have nothing to do.

He expresses astonishment at Mr. R. Philips's number 3.375 for alumina, not perceiving it to be his own number slightly travestied in order that alum might be content with two atoms at 3.375 = 6.75, instead of 3 atoms at 2.25 = 6.75. The Doctor's distress at this discrepancy is truly ludicrous, and will meet with no sympathy.

But Dr. Thomson has reserved his grand atomic *ballet*, that it might be performed on the three new earths, glucina, yttria, and zirconia. We shall exhibit merely an *entree* or two.

"Let us now calculate the composition of eudialite, on the supposition that all the bases are combined with silica, in the state of trisilicates, except the soda, which must be in the state of bisilicate.

"(1) 6 (atom of zirconia) : 6 (3 atoms

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* Thomson's Attempt, i. 200.

Thomson's Attempt, i. 241.

* Ann. of Phil. v. 105.

† Thomson's Attempt, i. 302.

silica) : : 11.102 : 11.102 = silica united to the zirconia.

"(2) 3.5 (atom of lime) : 6 (3 atoms silica) : : 9.785 : 16.77 = silica united to the lime.

"(3) 4 (atom of soda) : 4 (2 atoms silica) : : 13.13 : 13.13 = silica united to the soda.

"(4) 4.5 (atom of protoxide) : 6 (3 atoms silica) : : 8.816 : 11.75 = silica united to the protoxide of iron and manganese.

"Now 11.102 + 16.77 + 13.13 + 11.75 = 52.752. This is less than the whole silica in the mineral by 0.573. As the silica in combination with the zirconia constitutes $\frac{1}{48}$ of the whole, it is obvious that in order to have the quantity of silica united to the zirconia in the eudialite, we must add $\frac{1}{4.8}$ of 0.573 = 0.12 to 11.102, which will raise it to 11.222.

"This gives us, 11.222 : 11.102 : : 6 : 5.9358 = atomic weight of zirconia."*

Does the Doctor expect any man in his senses to receive the atomic weight of zirconia, so deduced? For elaborate frivolity we know nothing comparable to the above and its companion articles. The whole components of the mineral eudialite, as well as those of the other minerals, are undoubtedly associated by a reciprocal affinity; but our author pairs them out for his atomic pantomime, with all the gravity of a French dancing-master.

(*To be continued.*)

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* Thomson's Attempt, i. 339.

MISCELLANIES.

Fire-proof Wood.—Much alarm has been excited by the frequency and destructiveness of fires, of late, not only in the metropolis, but round about the realm, in town and country, in hamlet and in village, and on continent as in island. We believe that the introduction of *cast-iron* into use in, what may be called, domestic architecture, in England at least, will have a beneficial effect in quelling this evil, partially at any rate; but still we would offer to the consideration of our readers a composition, said to have been discovered by Dr. FUCHS, Member of the Academy of Science at Munich, whereby wood is rendered incombustible; the composition is made of granulated earth, which has been previously well-washed in a solution of caustic alkali, and cleared from every heterogenous matter; this mixture, which is not decomposed by either fire or water, being spread on the wood, forms a kind of vitreous coat, which is also proof against each of these opposing elements. The building committee of the royal theatre, in that city, has made two public experiments on small buildings, six or eight feet long, and of a proportionate height: one covered with the composition, the other left as usual,—the fire was kindled in each equally; that not covered with the composition was quickly consumed, the other remained perfect and entire. The cost of this process is trifling—only about 20d. per 100 square feet. The theatre has been submitted to the process, containing nearly 400,000 square feet. The late Earl Stanhope made some very successful experiments of the kind—he coated a building with a mixture of sand and glue, which proved completely fire-proof.

Ashton-Under-Lyne Mechanics' Institution.—Mr. Heywood, in the course of his inaugural address to the Stockport Institution, observed, that the Mechanics' Institution of Ashton-under-Lyne had not been established more than three months, and, on the authority of the President, he was enabled to state that a material alteration had already taken place in the mechanics of that town. Upwards of two hundred members have been enrolled on the books of the Institution, and the zeal and attention they display in the attendance of lectures, and their frequent visits to the library, have astonished their warmest friends.

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> "Rich Industry, with toil embrowned;
> Content, with brow serenely gay;
> And genial Art's refulgent ray."

No. CV. *Saturday, 24th December,* 1825. Price 3*d.*

NEW CROSS CUTTING SAW.

Invented by Mr. Dixon Vallance, Libberton, Lanarkshire.

Fig. 1

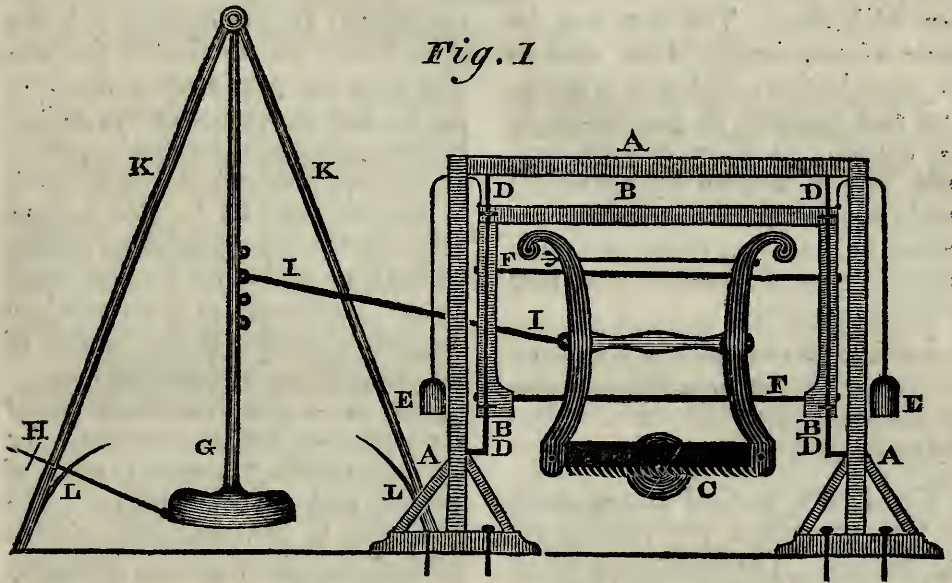
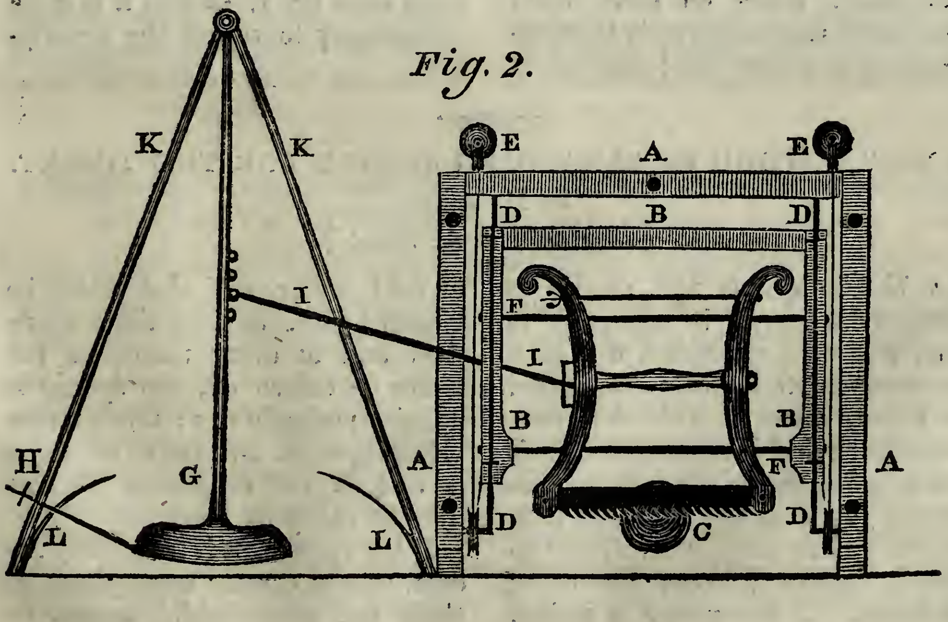


Fig. 2.



NEW CROSS CUTTING SAW.

Invented by Mr. Dixon Vallance, Libberton, Lanarkshire.

Gentlemen,—I send you herewith a plan of a cross cutting saw, a contrivance of mine for cutting standing or lying trees. The common cross cutting saw requires two men at least, and sometimes a considerable number, to cut large trees; but, by the help of this new instrument, one man will cut the largest tree with ease. The saw may be made of any length, from two to six or eight feet; and with a thickness and breadth in proportion to the length. It slides on two steel rods, put in motion by a weighty pendulum; and the rods are attached to the outer frame, which is firmly fixed to the ground with four or five iron pins.

I am, Gentlemen, yours, &c.

Dixon Vallance.

Description of the Engraving.

Fig. 1, is a vertical arrangement of the apparatus for cutting lying timber. The pendulum-frame is here seen in its vertical dimensions. The saw, which, as I have mentioned, slides on steel rods, cuts much more accurately than the common cross cut saw; and might with advantage be employed in the cutting of marble. A, A, A, is the outer frame; B, B, B, the inner frame; C, the saw; D, D, D, D, the rods on which the inner frame slides; E, E, the weight which regulates the cut of the saw; F, F, the rods on which the saw slides, when moved by the pendulum; G, the pendulum; H, the handle; I, I, the shaft which communicates the motion from the pendulum to the saw; K, K, the pendulum frame, which is four standards jointed together at the top, the points being stuck in the ground; L, L, two springs between which the pendulum moves, and which make its motion more easy. The length of the pendulum may be, according to the length of the saw, from six to twelve feet.

Fig. 2, is a horizontal view of the same apparatus, arranged for cutting standing timber; and, of course, acting horizontally. The pendulum is here, however, shown vertical, in order the more distinctly to show its movements. The different parts are here marked the same as in fig. 1, so that it is quite unnecessary to repeat the description.

A NEW METHOD OF BLEACHING SPONGE FOR THE TOILET.

By M. Vogel.

[Translated from the French.]

To bleach sponge and render it perfectly white, it is necessary to soak it in cold water, but if it does not become soft, it must be immersed in boiling water. This, however, should, if possible, be avoided, for it has a bad effect on the sponge, particularly in cooling; it causes it to shrink and to become hard, and so tough, as to prevent its being bleached. If the sponge is soaked in cold water, and that water be changed three or four times every day, and at every time that the water be drawn off, the sponge is pressed perfectly dry; this process being repeated for five or six days, it will at the expiration of that time be ready for bleaching.

If the sponge, as is frequently the case, should contain small pieces of chalk and shells which cannot be got out without tearing it, the sponge must be soaked for 24 hours in muriatic acid, with twenty parts of water, which will cause an effervescence to take place, and carbonic acid gas to be liberated, when the shells and chalk will become perfectly dissolved. After that, it must be carefully washed in fresh water, and immersed in sulphuric acid, the specific gravity of which must be 1.024 or 4° on the hydrometer of Beauiné. The immersion of the sponge in this acid should continue for about eight days; but it must occasionally be pressed dry and thoroughly washed. After having been perfectly washed and cleaned, it should be sprinkled with rose water, to give it a pleasant smell, which completes the process.

ON THE FORMATION OF THE CELLS OF BEES.

The mode in which these insects construct the cells of the honey comb, engaged the attention of men of science at a very early period. Pappus, the geometrician, investigated the subject, and it has been demonstrated that the system of cells which compose a honey comb is constructed in strict conformity with geometrical principles. In order that the honey comb may occupy no more space than is absolutely necessary, it is evident that there should be no interstices between the cells. There are several different polygons, possessing the important property of filling space, about a given point; but it is demonstrated that of all these the hexagonal prism is of the most economical structure. Now this is the model according to which the bee really works; but a complete hexagonal prism is not, in every respect, suited for the purpose. The safety of the grub, and the preservation of the honey in which it is bedded, and which is its nutriment, require that the cell should terminate in a solid angle rather than in a flat surface. Here again there is a choice of figure, and indeed an infinite variety of modes in which such a termination might be formed as requiring the least quantity of labour and materials, and the cells of the honey comb have been shown by Maraldi, upon exact measurement, to terminate on that very angle which is mathematically ascertained to render the surface the least possible in such a structure.

REMARKS UPON GROUND-ICE, OR ICE FORMED AT THE BOTTOM OF RUNNING WATERS.—By Professor Merian.

[Abridged from his Memoir, read before the Natural History Society of Basle.]

The name of *ground-ice* is given to the detached and separated masses of ice, which running waters carry at their surface, during a frost of some duration. This ice differs from that continuous kind which is formed along the edge of rivers, and particularly in places where the water is quiet; it never forms in lakes, pools, or other stagnant water, and motion appears to be a condition essential to its existence. At first sight it might be taken for an aggregation of snow penetrated by water, swimming at the surface, rather than for ice; but a closer examination will not fail to discover its true characters. In fact, it is formed of an assemblage of a multitude of small, thin, and rounded plates of ice, having a diameter of a few lines. They are individually transparent, but their aggregation presents, at a distance, the appearance of a semi-transparent mass like wet snow. It is known that, before rivers begin to carry the ground-ice, the temperature of the air must have been for several days previous some degrees below zero; and it is observed in general, that a cold wind, blowing in a direction contrary to the current of the river, is singularly favourable to the formation of this sort of ice.

We might at first be induced to suppose that the ice in question must be formed at the surface, as is the case with that of smooth water, because the effect of the cooling of the atmosphere is more intensely felt at the surface, and water at a temperature below + 3° C., that is, below the point of its greatest density, becomes lighter, in proportion as the cold augments. It might, therefore, be supposed, that water which is near the point of congelation, has a tendency to remain above, and that, consequently, the ice should begin to form at the surface. But although this is the case with regard to standing water, it is different with respect to streams; in them the ground-ice is really formed upon the soil which constitutes their bed. Any person may easily convince himself of the fact, in a pretty severe winter, by examining what takes place in a river which carries ice, and which is shallow enough to let him see the bottom. In the winter of 1823, the canal of St. Alban, which conducts the waters of the Birse through the town of Basle, carried a considerable quantity of ground-ice. The clearness of the water was such, that objects were distinctly visible at a depth of three feet. The bed of the canal in this place is covered with rolled pebbles. Wherever a projection was perceived at the bottom of the water, in the deep places as well as those less so, there was seen a bundle of bits of ice which had been formed there, and which, at a distance, presented the appearance of cottony tufts. In several places nearly the whole bottom was covered in this manner, and the fasciculi were detached from time to time, and came up to the surface of the current, which is very rapid. The fasciculi which were taken up by the hand from the bottom, presented exactly the same appearance as those which rose to the surface of themselves, and which were floating about in great quantities. They were composed, like the latter, of small rounded and agglomerated plates of ice; so that no doubt could exist with regard to the origin and mode of formation of the floating ice. The uniform and peculiar arrangement of the ice which appeared at the bottom of the water, entirely excludes the supposition that it might have been precipitated from the surface.

The following explanation of this phenomenon is what M. Merian considers the most natural. If it be true that, in winter, running water is first cooled at the surface, it is also true, that its constant agitation, especially when aided by a wind blowing in a direction contrary to that of the current, continually mixes the water of the surface and that of the bottom, notwithstanding the inconsiderable difference of their specific gravities. The temperature of the bottom and that of the surface, even in pretty deep rivers, does not present any remarkable difference, while the prominent bodies fixed to the bottom, present points of attachment to the forming ice, much more advantageous than a constantly agitated surface; and it is well known what influence these points or nuclei have in general upon crystallization. The water sufficiently cooled begins, therefore, to be converted into ice at the bottom, particularly in the places where shelter is afforded by prominences from the impetuosity of the current. The continual motion which takes place in the interior of the water, presents the same obstacle to the formation of large masses of ice, which is presented to the crystallization of common salt, by agitation of the liquid which holds it in solution; and there are only formed in consequence simple agglomerations of small plates of ice imperfectly crystallized. When these agglomerations have accumulated so as to present larger masses, they are detached from the bottom, either by virtue of their greater lightness, or from the impulse of the current, and rise to the surface, frequently carrying with them fragments of the soil itself. In fact, it is not uncommon to find sand, gravel, mud, or other substances, attached to the ground-ice, and floating with it upon the surface.

He then mentions his having searched, in different authors, for observations which might serve to confirm or refute the above theory, but with little success; for modern writers seem to have overlooked the subject; and it is almost exclusively in the older works that any particular notice is taken of it. Plot, in his History of Oxfordshire, observes, that all the watermen with whom he has had an opportunity of speaking on the subject, agree in thinking, that the rivers of the country always begin to freeze at the bottom. He describes the manner in which the small pieces of ice, called *ice-meers,* rise from the bottom to the surface, and mentions their frequently containing gravel or stones, which they have carried along with them. Hales confirms these observations; and says, that the watermen of the Thames assert, that, some days before that river is frozen at the surface, they feel the ice at the bottom with their poles, and that they see it rising to the surface. He gives, also, several observations of his own, clearly establishing the fact. These observations, M. Merian remarks, serve to show, that the ideas indicated by the German name *grundeis,* are generally diffused among the country people in England, and present a detailed relation of facts furnished by an observer, whose accuracy can be relied upon; and from these facts we may conclude, that there forms, at the bottom of running water, not only an ice disposed in tufts, but also, when the circumstances are favourable, a layer of compact ice.

Of the more recent observations upon this subject, he mentions that of Mr. Streake, who relates, that, in February 1806, at Pillau, chains of iron, six feet in length, which had remained for a long time lost at the bottom of the water, a cable thirty fathoms long, and stones weighing from three to six pounds, were raised to the surface, enclosed in a thick envelope of ice; and that an anchor, after having remained an hour in the water, was taken out covered with a layer of ice.

In conclusion, the author observes, that, after having adduced proofs of the formation of ice at the bottom of running water, he has to remark, that it cannot by any means be pretended that this ice, once raised from the bottom to the surface, does not augment in a remarkable manner. This result, on the contrary, appears probable: because the pieces of ice which are already found at the surface, being at least as cold as the bottom, must present nuclei, whose presence contributes to the freezing of the water. This freezing of the surface will especially extend, when, from any circumstance whatever, the ground-ice may be stopped in some places, and will there form a more or less compact mass. Nor does he deny, that, in certain cases, ice may be formed, even at the surface of running water; but he thinks it sufficiently established, that ice is formed at the bottom of brooks and rivers; and the characters of this ice being entirely similar to those of the ground-ice which floats at the surface, it is more than probable that they have a common origin, and a common mode of formation.

ON THE DISEASES INCIDENT TO MECHANICS.

By a Physician.

On the diseases to which Tailors are exposed by their occupation.

The beneficial tendency of exercise in invigorating the human frame, is a fact of the most established character. Yet a very large proportion of the numerous trades and occupations of men are carried on either in the most sedentary postures, or in places the atmosphere of which is very seldom duly changed, consequently charged with the most unwholesome effluvia. As an example of a business in which the sedentary habits, inseparable from some trades, are productive of diseases, I would select that of the Tailor. The pale, and generally unhealthy aspect of this class of workmen, in a great measure characteristic of the trade, arises from the little exercise of the body their calling permits.

The position (it is too well known to require description,) custom has rendered peculiar to them, has a decided influence over the health of their bodies; and the bent attitude they assume in working, cannot fail to cause, by its constant pressure, some hurtful influence on the organs contained in the chest and belly. On the full development and healthy state of these organs, depend some of the most important functions of our frame—such as respiration, the digestion of food, &c. We would, therefore, expect to find the workmen of this trade subject to indigestion, inflammations of the stomach and bowels, cholics, jaundice, constipation, and piles. To the same causes may be referred the diseases of the bladder, not unfrequently met with among them. Every practitioner can bear testimony to the frequency of these diseases in the workmen under consideration. I myself have lately seen and cured three young tailors of well marked jaundice, which I could refer to no other cause than the bent position producing compression of the passages by which the bile was prevented from taking its usual course, and consequently absorbed into the system. I have said that we might expect that this class would be subject to diseases of the lungs and organs contained in the chest, and we accordingly find they are so. They are not unfrequently victims to that ruthless and insidious disease, consumption. Water in the chest occurs in those of the trade more advanced in life —and many tailors have been subject, through a tolerably long life, to a spitting of blood. I have observed, in several bodies of workmen of this trade that I have inspected after death, that the heart was larger than usual, and the vessels, too, arising immediately from it, were of a greater capacity than ordinary. M. Corvisart remarks, that diseases of the heart are not unfrequent in tailors, and I have had occasion to corroborate him in several instances.

An eruption, resembling the itch in its appearance, is an occasional complaint of tailors: some consider it owes its origin to the irritation of the cloths they handle; some to their mode of life. Both may occasionally operate as a cause. The whitlow is frequently met with amongst them. It is caused by their pricking their fingers in the neighbourhood of the nail. I have heard of, but never saw, a case of the inflammation spreading up the arm, and proving either a very dangerous or a fatal affection, from a puncture of the finger with the needle. They, in common with all trades working with candle light, and looking on dark objects, suffer from affections of the eyes.

Yet the physical power of this class is not by any means, however, so much impaired as (taking all things into consideration,) I should have expected; and I have often observed men of this trade exhibit a degree of strength and vigour, *such as did honour* to their pugilistic powers.

It may not belong to our subject, perhaps, to notice the influences of the trades of men over the moral part of their constitution; still, as the subject is extremely curious and interesting, I cannot altogether think it idle or useless to notice it. This trade has abroad a most infamous character for debauchery, gambling, theiving, irregularities, and extravagance; and it has been remarked, time out of mind, that a Flanders tailor is another epithet for a brawler and a rogue. This character by no means attaches to those of our own country; and, out of this very numerous trade, as many honest and respectable individuals are to be found, as in any other of equal numbers, and open to such a variety of characters.

Our next will contain some means of prevention, and remedies adapted to these affections.

New Invented and Improved Apparatus for conducting and containing Water and other Fluids, and preserving the same from the effects of Frost.

By Thomas Magrath, Dublin.

This improvement consists in coating the pipes or other vessels employed for the containing or conducting water, with pulverized charcoal, or some such imperfect conductor of heat; when the water in such vessels being surrounded and excluded from the action of the atmosphere, its caloric cannot be abstracted, by reason of the non-conducting properties of the coating; it is therefore prevented from freezing, and is preserved in its fluid state, however low the thermometer may stand in the open air.

The apparatus is simply a double pipe, that is, an ordinary pipe with a jacket surrounding it, which are kept from contact with each other by small collars or wedges of cork, or rolls of woollen placed between the two, and the spaces or vacancies are filled with pulverized charcoal. There may be two, three, or more pipes, one within the other, and the spaces between them occupied with the non-conducting materials, which will effectually prevent the abstraction of the matter of heat, by which the water is kept in a fluid state.

In a similar way water tanks or cisterns may be constructed, by making their sides, top, and bottom double, and introducing the pulverized charcoal, or such material, between the two; by these means the fluidity of the water will be preserved under all temperatures.

GLASGOW MECHANICS' INSTITUTION.

SUBJECTS FOR ESSAYS PROPOSED BY MR. DEUCHAR FOR THE STUDENTS ATTENDING HIS CLASS.

[Continued from page 264 of the present Volume.]

The following five questions are meant for those of the class more advanced:—

9. What is the theory of the operation of the syphon?

10. What are the general results of chemical action?

11. Upon what circumstance depends that character of bodies which makes us call them light or heavy?

12. What are the most prominent features in the history of chemistry?

13. What kind of vacuum do we obtain by means of the air-pump? and how do we obtain that vacuum?

The following five questions are for the consideration of the younger pupils:—

14. What is gravitation?

15. What is capillary motion?

16. What is chemistry?

17. What is the science of mechanics?

18. What are the properties of matter?

All these questions must be illustrated from the lectures which have been delivered, and the 9th, 10th, 11th, 14th, 15th, and 16th, must be given in before the 7th of January, 1826; and the 12th, 13th, 17th, and 18th, before the 14th of January, 1826.

Solutions to Questions formerly proposed.

On Tuesday and Wednesday last, Mr. Deuchar stated to his respective Classes, in the Mechanics' Institution, the result of the solutions which had been given in to explain the second question, regarding the minute division of camphor, (page 264, Vol. IV.) He mentioned that some had fallen into an error regarding the number of cubic inches in a cubic foot of air, employing the number 144 instead of 1728; others, to get the fractional part of the air, had by mistake multiplied by 10 and divided by 3, instead of multiplying by 3 and dividing by 10. The best solutions were given in by Messrs. William Barr, Robt. MacCaulay, John Maconochy, R. H—, William Sawers, Dugald M'Dougall, William Pattison, and some without any signatures.

Solutions given in by Mr. W. Barr, Mr. R. MacCaulay, and Mr. R. H—.

12 inches in a foot in length.
12

144 inches in a foot square.
12

1728 cubic inches in a cubic foot.

30 feet, the length;
20 the breadth;

600
15 the height;

9,000 cubic feet in room;
40 days;

360,000
3 times changed;

1,080,000 feet of air changed;

[Carried to next page.]

1,080,000 feet of air changed;
1728 inches in a cubic foot;

8,640,000
21,600,00
756,000,0
1,080,000

1,866,240,000 cubic inches changed;

Therefore each cubic inch of air will have dissolved only the $\frac{1}{1{,}866{,}240{,}000\text{th}}$ part of a grain of the camphor to which it was exposed.

1,866,240,000 cubic inches.
3
1,0)5,598,720,00,0
559,872,000 weight of air changed.

Therefore the air has dissolved of the camphor only the $\frac{1}{559{,}872{,}000\text{th}}$ part of its weight.

ON THE ARCHITECTURE OF MANUFACTORIES.

A clever article on this subject has appeared in the last Number of the London Magazine; and as it is a subject of no little interest in this part of the country, we shall give a few extracts from it. It is certainly to be regretted that so little attention is paid to ornament in the erection of our public works; though we are quite certain that at almost no additional expense the various manufactories with which our city is filled and surrounded, so far from disfiguring it, as they have all hitherto down, might be made to conduce to its ornament and grandeur, as they at present do to its wealth.

The attention of this writer in the London Magazine had been called to the subject by seeing, in the course of a professional visit to South Wales, an iron manufactory, which is at present erecting, in which an attempt is making to unite architectural taste in public works. This work is but yet just begun, but so far as this gentleman could understand, the whole of the buildings required for the work are to be as purely Egyptian as it is possible to make them, consistently with the disposition and arrangement required for the several shops, casting-houses, furnaces, and so forth. "It appears," says he, "that they are to be arranged in a straight line, and placed in a symmetrical manner; that is, in such a way that every building will be repeated in a corresponding manner from a common centre; and as the total extent, according to the account I received, will be 400 yards, it is easy to conceive that the effect will be very striking. The place itself is a wild narrow valley among the upper hills, on the road from Brecon to Cardiff; and I can easily conceive that when finished, it will be a point of attraction for travellers, and that it will convey a lively idea of an ancient Egyptian city."

"A manufactory," he says, "is a permanent work, and it ought to be built to last. This is one reason why these structures should be built of stone, as it is impossible to produce any effect with brick, particularly with those horrid red bricks which you see all over the country. It is as easy to make bricks white as red, if the makers choose; but indeed the taste of the public is so bad that they actually prefer the red colour, just as the Dutchmen paint their pleasure houses in stripes, and as even stone houses are coloured on purpose that they may look like bricks.

"In a manufactory, there is every thing that an architect can desire to work with. There is generally abundance of room, dimensions, length, and heighth; circumstances with which an artist could do any thing if he were allowed his own way. Let him have the walls, give him the doors, and the windows, and the roofs, and the chimneys to manage, and he will have no trouble in constructing for his employer a beautiful building.

" I am much pleased to find that the Egyptian style has been selected for this manufactory in Wales, as it is a mode of architecture to which I have been strongly attached from the moment I first knew it; though, unfortunately, there are few opportunities among us of introducing it, partly from the general nature of our buildings, and partly from the ignorance of the public about Egyptian architecture.

" This style is particularly appropriate for such buildings as this in which it has been attempted, as if indeed it had almost been invented for this among other purposes. This may be immediately perceived in travelling among the iron works; as the furnaces, or cupolas, as they are called, have already a very Egyptian air about them, from their mass and solidity, and the inclination of their walls or general outline. Hence they would combine admirably with such other parts of the buildings as the architect could contrive to design and dispose according to Egyptian rules; and I have little doubt that if the work has been well considered it will form a very beautiful and harmonious whole.

" As I have undertaken to defend the Egyptian style of architecture, I may as well begin with the economy of that system. This is what I hold to be one of its fundamental merits. It is the style which produces the greatest effects with the least ornament; and thus it is the reverse of the Gothic, which gains all its ends in the exactly opposite way. It is far cheaper than any style which can be properly called Greek, or than any variety of Palladian architecture; provided that this is to have any effect or pretend to any beauty.

" Its economy consists principally in this, that it can dispense with columns, while there is no architecture derived from the Greek where they are not indispensable. No striking entablature, which gives it so much character, can be used without columns, while it has no pilasters; and its door-ways also can be made ornamental without columns; which a Greek doorway cannot, because, in fact, the original Greek door-way is nothing, and is only made endurable by our own modern inventions, which foolish people imagine to be Greek.

" Another cause of the economy of the Egyptian architecture is the few ornaments which it requires, or even admits. This is a high merit in itself; but it is a principal merit in this point of view. In a plain building, or a building in the simplest Egyptian style, the entablature, and the reeds or cords at the angles, with the head-bands and cords round the doors and windows are ornaments enough; and if we should desire more, a few flutings under the head-bands, with the winged globe, wherever it may be convenient, are ornaments enough, and indeed all that it admits.

" As an architect, I must now notice another economical consideration, particularly wherever it is adopted for manufactories, and that is the strength and stability of the walls, arising from their inclined position, or rather the circumstance that the base is broader than the upper part. This produces the peculiar effect which characterises the Egyptian system; and the superior strength which it affords, is well known to every mason: it is peculiarly well known to engineers, since it is adopted in all military works of fortification.

"By means, then, of the Egyptian style of architecture we can produce a plain, solid, strong building, pleasing to the eye, full of effect, creditable, having the appearance of science, taste, and ornament, with far less expense than we can produce any other decent looking building in any style of architecture that can be called architecture. And as a practical and an experienced man, I will venture to say too, that I will produce such a building at an expense of not above one per cent. above the hideous manufactories that I see all over the country, which have no pretence to architecture or ornament at all. This is the consequence of its extreme simplicity; of the powerful effect produced by its entablature, and by its doors and windows; and of the small quantity of mere ornament which it requires.

"As to the iron works, (and the same rule applies to all other manufactories,) they do a great deal of their work with arches, and they never compute what that work costs. Their arches cost abundance of money, and only cause deformity; whereas, in the Egyptian style, all the expense of arching is saved, and every thing tells in the beauty of the building.

"These are the principal reasons for recommending the style: as I know very well that I must not propose expense to manufacturers, that is the cheap way in which a great effect and great beauty can be produced in this manner. But even if they wished to produce buildings really ornamental, or to have columns; if they should wish to erect churches or public buildings in this manner, then I say that the Egyptian style allows of the same effects as the Greek, with less expense.

"The reason is that its columns are cheaper in themselves, and besides, that with a smaller number of columns we can produce as good an effect, owing to the general simplicity of this system of architecture. The fundamental system of the Egyptian architecture is more effective; because it can stand alone and produce its effect, without additional ornament, while it shall also look like an ornamented work; but in any Greek, or variation from the Greek, a building is helpless and bare unless it is fully ornamented; and therefore a little ornament goes a great way to the former; besides which, there is not such a use for columns, or such a demand for them."

INVENTION FOR FORMING A LINE OF COMMUNICATION IN CASES OF SHIPWRECK; AND A FIRE-ESCAPE IN CASES OF FIRE.

Mr. Murray, whose pamphlet on the silk worm we noticed in a recent Number, has just published another interesting one, containing a descriptive account of a shower-bath invented by him, an apparatus for restoring suspended animation, and an invention for forming a line of communication with the shore, and a fire-escape in cases of fire.* We shall give an account of his shower-bath and apparatus for restoring suspended animation in a subsequent Number; and in the mean time we extract his account of his invention for preserving lives in case of shipwreck or fire.

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* Glasgow; W. R. M'Phun. London; Knight & Lacey. 1826.

" The invention of Captain Manby affords to the eye of the christian and the philosopher, a spectacle of the most beautiful and sublime description. We are summoned to witness the murderous weapon become the messenger of protracted life, and the deadly ball, guided by an omnipotent Providence, fraught with the celestial message—' Ye shall live, and not die!'

" This valuable invention, however, it is to be regretted, is not always available. The rope *frequently snaps,* and that too, perhaps, in the most perilous juncture; and besides all this, it is difficult to manage the required elevation so *that the parabolic range be rightly adjusted* to the distance and position. In a recent instance, off Whitby, the shot in the first attempt fell short, and in the second trial, the rope broke. The distance of this vessel from the shore, was every way adapted for the plan I am about to recommend; and a gentleman of considerable scientific attainments, who explained my invention to several individuals at Whitby, informed me that in all human probability it would have saved the crew and passengers, by establishing a line of communication with the shore. '*Occidit quod non servat.*'

" The disastrous circumstance of a shipwreck off the coast of the Isle of Man, in which the crew and passengers, to the number of thirty, were consigned to the watery abyss, at a distance from the shore, not exceeding fifty or sixty yards, first led me to consider the practicability of using the *common musket* in like cases, where the distance might not be considerable.

" In my first experiments in the summer of 1817, made in the Isle of Man, with Captain Garbett, R. N. and several other gentlemen, a musket bullet was employed; to this whip-cord was fastened, (as it occurred to me that whip-cord might be strong enough to bear a log-line, and this last carry a rope on board. In all my numerous experiments, however, the cord *broke,* and the like issue supervened with silk, catgut, hair-cord, brass-chain, &c. I found that all these snapped *within* the barrel. I presumed, therefore, that if a substance could be found of sufficient strength of material to carry the ball beyond the orifice, itself unbroken, it would finally succeed, and my object be gained; but every experiment had a similar unfortunate termination.

" Toward the close of the autumn of 1820, I made experiments of a different kind, crowned with the most successful results, and since that period, they have been repeated with similar fortune.

" Arrows of hiccory or ash, loosely fitting the calibre of the musket, are discharged with gunpowder, the charge being rather less than the usual quantity. These arrows are three or four inches longer than the barrel of the musket, and are shod with iron at the point,* having an eye through which the line is threaded. The lower end terminates in an iron socket, and this must be in *complete contact* with the wadding of the piece.

" A soldier's musket or a blunderbuss, will serve this purpose better than a fowling-piece, but any of them will succeed; and it is important to observe, that the line *never snapped,* while the average distance to which the *arrow and a log-line* were projected, might be estimated at 230 feet; in one case, indeed, an iron rod was carried 333 feet. but in this instance the line was favourably arranged. It is obvious that a smaller line would be propelled still farther; and when aided by the breeze, which would be most effectual, if the arrow was launched from *on board* toward *a lee shore,* the distance would be greatly extended; in the latter case, a plummed ruff might surround the shod summit of the arrow, inclining toward the eye.

" It must also be remembered, that as the experiment can be repeated from on board, the distance assigned to the flight of the arrow would be *doubled.* The one from on board should have the appendage of a small float-board, to preserve the buoyancy of the arrow on the waves; and in the dark and stormy night, that from on shore ought to carry a port-fire, to mark its transit through the atmosphere, and guide the one from on board.

" Moreover, the life-boat can generally, if not always, get sufficiently near the shipwreck, to propel the line on board by the proposed method, or rather, *vice versa,* to be the messenger of a line to the shore, projected from the vessel.

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* Should the line be attached to a ring, and this ring hung on a metallic rod, resting in a groove on one side of the arrow, the arrow would not be *reversed* in its transit through the air, which must always occur otherwise; for in the first impulse, the ring would glance up to the lower end of the arrow, by the metallic rod: one cause of resistance and retardation would thus be remedied.

"These experiments explain the *cause* of the rope breaking in Captain Manby's mortar, and point out a method by which that misfortune may be remedied, while they show that a common swivel might be successfully used to launch an arrow, of dimensions adapted to its calibre.

"There is another interesting application of this invention. The arrow may be projected over lofty buildings on fire, and carry a line attached to a lengthened rope-ladder, which could thus easily be drawn over the roof to the other side, and instantaneously establish a fire escape for the unfortunate inmates that may have fled to the roof, the last pedestal of safety in cases of fire. The ends of the rope-ladder, thus easily established on both sides, should be fastened into the pavement by means of iron staples. It is obvious that the rope-ladder could easily be removed to any part of the building, to receive the unfortunates from the higher windows. A basket attached to the vertical ropes, and connected by cords and pullies, would receive the infantine, or the timid, sick, and infirm.

"The extreme portability of this apparatus—its aid so instantaneously available, and the promptitude with which it may be efficiently established, are recommendatory qualifications of primary importance. Each street might at least have one in constant readiness, and the fire offices would do well to consider the very simple means I have proposed. It is almost unnecessary to add, that the approximation of the vertical and parallel ropes, must be prevented by bars or slips of wood substituting those of rope, placed at specific distances."

REVIEW OF DR. THOMSON ON THE ATOMIC THEORY.

[From the London Journal of Science.]

(Concluded from page 288 of the present Volume.)

In the Tenth Chapter, on the atomic weights of iron, nickel, cobalt, manganese, and cerium, we have sought, but in vain, for any sound sample of chemical research. What is to be thought of such a passage as the following?

"From this statement it is obvious, that when 17.375 grains of protosulphate of iron are thus treated" (with a heat progressively raised) "7.59375 grains of water, or 7 atoms — $\frac{1}{4}$th atom, will be driven off; $2\frac{1}{2}$ grains of sulphuric acid will be converted into 2 grains of sulphurous acid, which will fly off, and half a grain of oxygen, which will convert the $4\frac{1}{2}$ grains of protoxide into 5 grains of peroxide. The remaining $2\frac{1}{2}$ grains of sulphuric acid united with 0.28125 grains of water, the $\frac{1}{4}$th atom still remaining, will be driven off in the state of fuming sulphuric acid."[*] Though "this statement" is quite absurd in an analytical point of view, it may be made instructive; for it displays strongly the inconvenience of the oxygen scale, compared to the hydrogen. The numbers, transposed to the latter scale, run thus: 139 grains green vitriol lose first $60\frac{3}{4}$ in water ($= 63 - 2\frac{1}{4}$); 20 grains of its sulphuric acid resolve themselves into 16 grains of the sulphurous, which fly off, and four grains of oxygen, which go to the 36 grains of protoxide, converting them into 40 of peroxide. The remaining 20 grains of sulphuric acid, united with $2\frac{1}{4}$ grains of water, the one-fourth atom unprovided for, will be disengaged in the state of fuming sulphuric acid. Will the Doctor maintain that the latter view is not far more intelligible than his, in which numbers with five decimal places of figures are required? And with regard to his method of determining the atomic weights of the above metallic bodies, nothing can be more unsatisfactory. We are persuaded that his numerical results would be less equivocally obtained, by a collation of the experiments of other chemists with the modern atomic theory, than by any inference from his own researches.

"I found many years ago," says he, "that when 100 parts of iron are oxidized by passing the steam of water over them at a red heat, they combine with 29.7528 parts of oxygen."[*] But from the experiments of M. Guy Lussac, it is known, that 100 parts of iron oxidized in this way, unite with 37.8 parts of oxygen. So much for the Doctor's experimental precision.

Now for his theoretical profundity. "Hence it would appear that this supposed oxide (of Guy Lussac,) is a compound of 1 atom iron + $1\frac{1}{3}$ atom oxygen gas."*

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[*] Thomson's Attempt, i. 347.

[*] Thomson's Attempt, i. 355.

We cannot devote much time to his Second Volume. Persons who can find amusement in haphazard experiments and gratuitous inferences, may look into his section on uranium, particularly the 4th and 5th pages. M. Arfwedson made some good researches on the combinations of this metal with oxygen, which Dr. Thomson as usual turns to his own account, by slight modifications. "To determine the atom of chromium I dissolved a quantity of chromate of potash in water, and added tartaric acid to the solution. An effervescence took place, and the solution assumed a fine green colour, because the chromic acid was converted into protoxide of chromium. Ammonia being poured into the green coloured liquid, the protoxide of chromium was precipitated. It was collected on a filtre, well washed, and dried in the open air."†

Now we affirm that this experiment, from which he deduces the atomic weight of chromium, was never made, for the result is impossible. *Ammonia does not precipitate oxide of chromium from the above green solution in tartaric acid.*

When solutions of chromate of potash and tartaric acid are mixed, there is an immediate formation of bitartrate of potash, which speedily falls down; and if the tartaric acid be in considerable excess, the chromic acid will be decomposed with effervescence. But the oxide in the resulting green liquid is *not precipitable by ammonia.* Yet Dr. Thomson builds upon a pseudo-experiment, one of his usual atomic structures. *Ex uno disce omnes.*

Our readers must, by this time, be nearly as tired, as we have long been ourselves, of this illusory and fantastic attempt.

He assigns 9 for the atomic weight of crystallized oxalic acid. The number 7.875 first given in the Philos. Trans. for 1822, is undoubtedly more to be depended on, particularly since it has been confirmed by "a chemical friend, of whose accuracy and information I (Dr. Thomson) entertain a very high opinion."‡

It is diverting to see the pertinacious effrontery with which he still refers to his experiments on oxalic acid, after the full exposure of their absurdity, in our review of his system (sixth edition,) and in our remarks on his answer to that review.*

He now sets to work, in his usual way, on the crystalline hydrate, to ascertain whether or not oxalic acid contains hydrogen. This point has, however, been determined so fully by the most delicate and decisive experiments, as utterly to supersede Dr. Thomson's tardy intervention.

Dr. Thomson's experiments to ascertain the atomic weight of tartaric acid betray a rudeness in practical chemistry, unaccountable in so old a hand. He describes tartrate of potash, as containing two atoms of water, separable by heat. The anhydrous salt has, according to him, an atomic weight of 14.25, to which 2.25 = 2 atoms of water being added, the sum 16.5 will be the number of the crystallized salt. 14.25 of the anhydrous salt, corresponding to 16.5 of the crystals, were found by him exactly equivalent to 20.75 of nitrate of lead. "The mother water (of the mixed solutions of these two salts) was tested with nitrate of lead, and tartrate of potash, without being in the least affected by either. Hence it contained no sensible quantity either of tartaric acid or of lead. The *whole* of these two bodies was contained in the precipitate which had fallen."

His number for tartrate of potash is unquestionably wrong; and, indeed, though it were right, his conclusion would be erroneous. For the *mother water* (as he elegantly terms the limpid supernatant liquid) contains, under his proportions, both tartaric acid and oxide of lead. Let it be tested with sulphate of soda, and it will become cloudy; with sulphuretted hydrogen, and it will become very black; or with nitrate of lead, and tartrate of lead will fall. Thus the principle of Richter, of whose application our Doctor is so vain, becomes, under his management, quite deceptious.

His determination of the atomic weight of acetic acid is liable to the same objections. He mixes solutions of 8.875 gr. of oxalate of ammonia (its true atomic weight appropriated as usual to himself, from a prior memoir in the Philos. Trans. for 1822) and of 23.625 grains of acetate of lead; and tests the supernatant liquid "by sulphate of soda and muriate of lime." Now we have the pleasure of informing the Regius Professor of Chemistry, that as a test of lead, sulphate of soda is good for very little on the present occasion; and indeed no accurate chemist would trust to it. *Acetate of lead and sulphate of soda can co-exist to a very considerable extent in a clear solution;* as the youngest tyro may prove, by adding to one portion of the supernatant liquor, muriate of barytes, and to another portion of the same, sulphuretted hydrogen or prussiate of potash. In the first case, a copious precipitate of sulphate of barytes will prove the presence of sulphate of soda; in the second, sulphuret, or ferro-prussiate of lead, will fall. In fact, let solutions of sulphate of soda and acetate of lead be mixed in the proportions indicated by Dr. Thomson's atomic weights of these salts, or in the most exact equivalent proportions; a portion of sulphate of lead will fall, and a corresponding portion of acetate of soda will be formed. To the supernatant liquid, (of any atomic proportion,) add carbonate of soda, and carbonate of lead will be separated in abundance. When the alkali ceases to act, let a current of sulphuretted hydrogen be passed through the supernatant liquid, and sulphuret of lead will appear. Thus also ferro-prussiate of potash will detect lead in a solution, when the proportion is too minute for the carbonate of soda test.

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* Thomson's Attempt, i. 355.

† Thomson's Attempt, ii. 51.

‡ Thomson's Attempt, ii. 103.

* Quarterly Journal, xi. 155, and iii. 349.

Dr. Thomson, from his unaccountable ignorance of these gradations of affinity, has given, as experimental results, quantities which it was impossible to obtain by the method of precipitations. And, hence, had they not been rendered *conformable* to the researches of Berzelius and other accurate chemists, as well as to the theory of equivalents, the odds would have been ten to one against Dr. Thomson's numbers in almost any case.

The above remarks apply strongly to his sections on citric, tartaric, and acetic acids. And we are somewhat surprised that he should expect any attention to his experiments on the ultimate analysis of vegetables, in which upwards of nine grains of the above crystalline acids are treated with only 200 grains of peroxide of copper. No certainty of their thorough decomposition, by the oxygen of the ignited oxide, can be insured; and the result must be destitute of all authority.

We have now adduced ample, even superfluous, evidence, of the strongest negligence or incapacity in the conduct of his researches on the atomic theory. And, moreover, the perplexity into which he runs, in considering the partial and erroneous canons of Berzelius, is a decisive proof that his general views are neither clear nor comprehensive. In our Journal for January 1822, page 307, we endeavoured to show the fallacy of these pretended general laws of Berzelius. This development of ours seems to have fallen under the Doctor's talons in an unhappy hour; for he tortures and disguises it most unmercifully. We request our readers to compare the passage referred to in our Journal, with Dr Thomson's "few words respecting Berzelius's law," at p. 469, et seq. of his 2d volume.

The style of writing adopted by the Doctor, in this new work, ill accords with the lofty panegyric pronounced by himself on his literary attainments. "*I am remarkably concise, though I hope always clear, and generally energetic.*"* We humbly apprehend, that more obscure, flat, and tautological phraseology, than that of which the present "Attempt" is *made up*, is not to be found within the precincts of any English book-factory. Its periodic movements are heavy and reluctant like those of a worn-out atmospheric engine.

In a prefatory address to the students of medicine and chemistry in the university of Glasgow, he advertises them, that his "future courses of lectures will be more entertaining and varied." He assures us that his first reason for publishing this book, "is the great advantage which medical practitioners will derive from a knowledge of the atomic weights of bodies, and of the weights of the integrant particles of the salts, &c. which they have occasion to employ in their prescriptions. This knowledge will be easily acquired by a *perusal of the following pages;* and it will enable those who possess it, to avoid some very awkward blunders into which I have observed too many practitioners, even of considerable celebrity, frequently to fall, to the *no little inconvenience* of their patients."*

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* Annals of Philosophy for April, 1822, p. 245.

Of the merit of his work, the Doctor speaks so authoritatively as to set criticism at defiance. Having affirmed that the present publication will be of no little service to all medical men, and medical students, he says: "The tables contained in this work ought to occupy a place in every laboratory, and to lie *upon the shop* of every druggist, that he may have it in his power to have recourse to them to regulate *all* his processes."†

The fashion of paper roofs having gone out, we think it doubtful whether his pages will have the fortune to lie *upon* the shop of every or even of any druggist; but there is another shop where a pulverulent drug is retailed, on whose counter his pages may possibly appear.

Conceit of knowledge prevents its acquisition. Dr. Thomson, having persuaded himself that all his experiments, however ill-devised or ill-executed, are of infinite value and perfect precision, modestly tells us, that Berzelius and Dulong are in error by $\frac{1}{113}$th part, while his own results are quite correct; though in reality they are incomparably more inaccurate, when their errors are not veiled by counterbalancing errors in arithmetic.

There are a few passages of his work composed in a better spirit, and rather freer from the arrogance that blinds him. On these we would willingly have bestowed commendation, had the author not forestalled for himself every laudatory form of expression.

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* Thomson's Attempt, i. Preface viii.

† Thomson's Attempt, i. Preface xiv.

MISCELLANIES.

Employment of Caustic to destroy the Variolous Eruption.—M. Velpeau read a memoir to the Royal Academy of Medicine, tending to prove that if the pustules of the small pox are cauterized within the two first days of their appearance, they die away entirely; and if this be done even later, their duration is abridged, and no traces of them are left. The caustic he employs is a solution of nitrate of silver, in which he dips a probe, with which he pierces the centre of each pustule. M. Dumerel says that he has been long familiar with this practice, but instead of the solution, he employed the solid caustic itself. (Archives Générales.)—*Med. Jour.* liv. 170.

New Musical Instrument.—Mr. Schultz, from Vienna, who is now on a visit to Liverpool, has introduced a new and fascinating keyed instrument, called the *Physharmonica,* the delicious tones of which are produced by the friction of steel bars, or some other substance. The mechanism and the principle yet remain a secret with Mr. Schultz. The crescendo on this instrument is produced by the pressure of the finger, so that it admits of every modification of expression; and what is most surprising is, that it admits of more rapid execution than the piano. It is difficult to ascertain to what class of instruments the tone of the Physharmonica belongs. A French critic assimilates it to the fine sounds of the hautboy, when played in a superior and very delicate style. The tone, however, which necessarily varies in character, in the treble, tenor, and bass, resembles the softest notes, not only of the hautboy and clarionet, but especially of the *vox humana* stop of the organ. It has all the beauty of the celestina without its defects.

NOTICES TO CORRESPONDENTS.

We can hardly give T. L. an answer without seeing the papers he alludes to. If he will favour us with a sight of some of them, with his name, if found to suit we may treat with him. We are sorry the insertion of Mr. W. Ballintyne's communication has been delayed, but we beg to assure him it was unavoidable. It will appear immediately after the New-Year. We must also apologize to J.A., Hanover Street, for delaying him likewise until another time.

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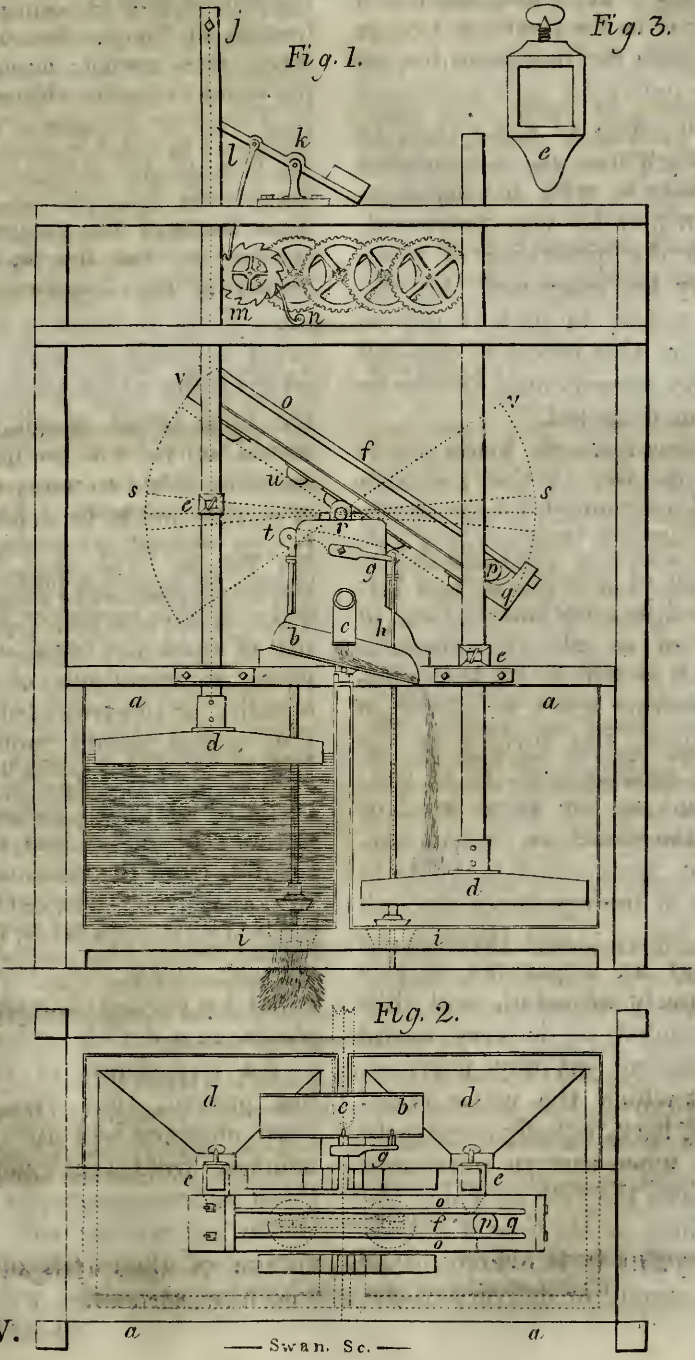
A Committee of Civil Engineers and Practical Mechanics.

> "For, lo! with modest, yet majestic grace,
> I curb imagination's lawless rage;
> And from within the cherished heart to trace,
> Philosophy appears."

No. CVI. *Saturday,* 31*st December,* 1825. Price 3*d.*

HYDROMETROGRAPH: OR, MACHINE FOR MEASURING WATER OR ANY OTHER FLUID.



— Swan. Sc. —

DESCRIPTION OF A HYDROMETROGRAPH, OR A MACHINE FOR MEASURING AND RECORDING THE QUANTITY OF WATER, OR ANY OTHER FLUID, DISCHARGED WITHIN A GIVEN TIME FROM CONDUIT PIPES.

Invented by the Chevalier JOSEPH DE BAADER, of Munich, in the Kingdom of Bavaria.

[From Gill's Technical Repository.]

THE first idea of the Hydrometrograph was conceived by the Chevalier, and communicated by him to various persons in Bavaria, many years since. It arose from the generally acknowledged want of an exact measure for the quantities of salt water delivered and employed in different parts of the extensive Royal Salt-works at Reichenhall and Traunstein, with the management of which he was entrusted, and where the quantities of brine could only be *computed,* by the ordinary means, in such an imperfect manner, that errors of one-half the quantity passed could neither be avoided nor detected.

The means formerly made use of for this purpose, at the Bavarian salt-works, and which are generally known, consist in employing a certain number of gauge-pipes, or orifices, placed in a horizontal line, in the sides of an oblong prismatic vessel; and in which, by the opening or shutting more or fewer of those orifices, the surface of the water was endeavoured to be constantly kept at the same level or height in the vessel, so that its surface might form exact tangents to the circles of the apertures through which it issued; and there is no doubt, that an apparatus of this kind, properly adjusted, and diligently attended to, is very useful for ascertaining, at any moment, the *rate* at which the water is delivered; at least, equally accurately as the log, when thrown overboard a ship, shows the rate at which the ship is sailing, *at the time of the observation.* But it is evident, that unless the supply or delivery of the fluid be perfectly uniform and constant, which can hardly ever be the case, this method is quite insufficient for ascertaining, with any precision, the whole quantity of the fluid delivered in the course of a day, a week, or a month; as each apparatus would require the constant attendance of a person to regulate the level of the water in the guaging-vessel, by opening or closing the orifices of the guage-pipes, according to the diminution or increase of the supply; and, at the same time, to observe and keep an exact account of each change or interruption which takes place; and the final result of all this labour would only be a complicated calculation, liable to many errors, and, of course, not to be depended upon. It was, therefore, a most desirable object, to invent a perfectly correct and infallible measurer of the quantity of fluid delivered in any given time, independent of every inequality or interruption of the supply, which would require no attendance whatever, and would record, by its own mechanism, the number of cubic feet of fluid delivered, from the commencement of the operation, without any other trouble to the observer, than merely writing down the numbers indicated by certain indexes upon dial plates, in a decade order.

An experience of many years has proved, that this object has been obtained in a most successful manner, from the general use of these hydrometrographs in the Bavarian salt-works; and to the conviction of thousands of strangers, who have seen these works.

With respect to the application of it in this country, as it can be constructed upon any scale, either for measuring the largest quantities of water, or other fluids, or the smallest, so there are numerous instances where such an apparatus might be highly useful; as, for registering the quantities of water delivered from water-works; the daily supply of a stream of water, employed in actuating a water-wheel, or in the irrigation of a piece of land; in measuring and recording the quantities of wort or beer in breweries, and of brandy, or other valuable liquors in distilleries, &c. even down to pints and cubic inches to the greatest nicety. Nay, a machine of this kind, constructed upon a small scale, might be usefully employed in meteorology, as a convenient and elegant measure of the quantity of rain fallen every week or month throughout the year.

Description of the Machine.

Figs. 1 and 2, *a*, *a*, are two square vessels, each capable of containing more than five cubic feet of water, or other fluid; these are partly filled and emptied alternately, in the following manner:—*b* is a moveable trough, mounted upon an axis, into which the water is received from the pipe or main, *c*; in each of the vessels, *a*, *a*, is a hollow float of copper, *d*, *d*, which, rising with the water by means of an adjustable stud, *e*, (shown separately in fig. 3,) sliding upon the stem of the float, gives motion to a tumbler, *f*, which, by means of the arm, *g*, connected with a rod, *h*, descending to the trough, *b*, reverses it, and causes the water to flow into the other vessel, at the same time opening a conical valve, *i*, at the bottom of the full vessel, and discharging the water through it. When both vessels have been filled and emptied, a stud, *j*, upon the upper end of the stem of one of the floats, moves a lever, *k*, turning upon an axis, and having a counter weight at its opposite end, and a catch, *l*, near the other end of it, which moves a ratchet-wheel, *m*, having ten teeth around it; and which gives motion to a train of five pinions, of six teeth each, and four wheels, with sixty teeth each. On each of the five arbors are indexes, which show, upon as many dial-plates divided into ten divisions each, and numbered, any quantity of fluid which may have passed as far as 100,000,000 cubic feet, without any attendance, or the possibility of committing an error; *n* is a check-spring acting on the teeth of the ratchet-wheel, *m*.

The tumbler, *f*, consists of a wooden bar, mounted upon an axis in its centre; it turns up at each end, and two iron-rods, *o*, *o*, are passed through the ends, and secured by screws and nuts: these rods serve as guides to conduct a cast-iron ball, *p*, from one end of the tumbler to the other alternately; and which ball strikes and rests against leather pads or cushions, *q*, which are provided at each end of the tumbler to receive it. On the under side of the tumbler are two blocks, *r*, *r*, against which the studs, *e*, *e*, on the stems of the float, act; and when either end of the tumbler is raised to the position shown by the dotted lines, *s*, *s*, the ball suddenly runs down, and, by its momentum, strikes upon one of the ends of a lever, *t*, turning upon an axis in its centre, and from each end of which rods descend, to which the conical valves are hung, and thus suddenly opens one valve and shuts the other; at the same time assuming the position shown at *v*, *v*. There are two cast-iron blocks, *u*, *u*, fixed underneath the tumbler, to strike upon the ends of the lever, *t.* Gaps are made in the inner edges of the copper-floats, to permit the rods of the valves to pass freely by them. The whole machine is surrounded and inclosed in a proper manner, and strengthened by framing, which need not, however, be particularly described here.

MONTE ROSA.

[From the Baron WELDEN's Account of that Mountain.]

MONTE ROSA is finely seen from the rich plains of Lombardy. It is seen distinctly from the Gulf of Genoa, while Mont Blanc is concealed behind the mountains of Cogne and Saone. Baron Welden has observed Monte Rosa from the whole chain of the Appenines, from *Sasso di Castro*, above Loano, on the road from Florence to Bologna, from Monte Cimone, on the road from Modena to Pistoja, from Lacissa of Pontremoli at Parma, and also from the Col de Tende. In general it is seen in all directions to the south and the east, as the view of it is not interrupted by any mountains of sufficient altitude. Towards the east it is seen from the whole chain of Mont Cenis; and Baron Welden has observed it from all the chain of the Oberland in Berne, which stretches from the Gemmi and the Diablerets to the lake of Geneva.

Monte Rosa was called by the ancients *Mons Sylvius*, a name which was afterwards conferred on its neighbour, Mont Cervin. The name of Monte Rosa seems to have been first given to it by Scheuchzer, in his *Itinera Alpina*, in 1702—1711; and Baron Welden thinks that it derives its name from the roseate tints which the first rays of the rising sun throw upon its whitened summits.

The summit of Monte Rosa has not yet been reached by any traveller. One Maynard pretended that he had reached the summit on the 13th of August, 1813; but it is evident, from his own account, that the point which he attained was very far from the summit. In 1817, Professor Parrot of Dorpat, along with M. Zumstein of Gressonay, made two attempts to ascend this mountain, but both of them failed.

In 1819, M. Zumstein performed the interesting ascent of one of its southern summits, which we have published in a former number. He made a second ascent in August, 1820; a third in August, 1821; a fourth in July, 1822; and a fifth in August of the same year; an account of all of which is published at the end of Baron Welden's work.

The following are the observations which have been made at different times upon the height of Monte Rosa:

		Toises.	
In 1788, M. Oriani,	from Milan,	2389	
	from Mont Generoso,	2391	
In 1803,	from Milan,	2385	
In 1824, M. Carlini,	from Milan,	2374	
	from Turin,	2343	
	from Superga,	2357	
	from Mondovi,	2319	Rejected.
In 1822, Baron Welden,	from Monte Carnero,	2370	
	Mean height of Monte Rosa,	2373	

The following observations have been made at various times on Mont Blanc:

			Toises.
In 1796,	M. Tralles,		2468
In 1821,	M. Carlini,	from Mont Colombier,	2460
	The Austrian Engineers,	from Mont Trelod,	2462
		from Perron d'Encombres,	2459.9
		from the Glacier of Ambin,	2463.9
		from Roche Melon,	2458.8
	The French Engineers,	from Mont Granier,	2460.1
	Mean height of Mont Blanc,		2461.8
	Do. of Monte Rosa,		2373.0
Hence, Mont Blanc is higher than Monte Rosa by			88.8 Toises.

As some persons have claimed for Mont Oerteles, in the Tyrol, an elevation equal to that of Mont Blanc, we shall give the following measures of its height, as obtained in 1818 by the Austrian Engineers, from the triangulation which they then conducted in the Tyrol.

		Toises.
In 1818,	from Pflinn Spitze,	2012.5
	from Monte Motto,	2010.1
	from Corno di S. Colombano,	2009.5
	from Pizzo del Ferro,	2010.0
	Mean height of Oerteles,	2010.5
	Height of Mont Blanc,	2461.8
Hence, Mont Blanc is higher than Oerteles by		451.3 Toises.

VARIOUS PLANTS USED AS TEA IN DIFFERENT COUNTRIES.

The plants used as tea are as widely separated from each other as the countries themselves are remote. In Mexico and Guatimala the leaves of the *Psoralea glandulosa* are generally used as tea; and in New Grenada the *Alstonia theæformis* of Mutis, the *Symplocos Alstonia* of Humboldt and Bonpland, affords a tea not inferior to that of China. Farther to the north, on the same continent, a very wholesome tea is made from the leaves of the *Gaultheria procumbens* and *Ledum latifolium.* This last is vulgarly called Labrador tea, and its use was, I believe, first made known by the late Sir Joseph Banks. The most famous of all American teas, however, is the tea of Paraguay, of which large quantities are annually imported into Peru, Chili, and the States of Buenos Ayres, and the use of it is so universal in South America, that the inhabitants have always some of this tea ready prepared, whether engaged in occupations at home or in the fields, and no person departs on a journey without being provided with a quantity of the herb. It is made by merely pouring warm water on the leaves, and is sipped, through a silver or glass tube, from a small vessel, called a Matè Pot, which is carried in the hand, or, should the person be on horseback, or engaged in any occupation requiring the use of his hands, it is suspended from the neck by means of a small chain. It is frequently mixed with a little lemon juice, and is used either with or without sugar. European travellers with whom I have conversed, prefer this to any of the teas imported from China. The Paraguay tea is the more remarkable, from its being the produce of a species of holly, a genus hitherto considered as deleterious. It is described and figured under the name of *Ilex Paraguensis* in an Appendix to the 2d volume of Mr. Lambert's work on the genus *Pinus*, and is noticed by M. Auguste St. Hilaire in the "Memoires du Museum," under the name of *Ilex Mate*, and by Drs. Spix and Martius, in their Brazilian Travels, under that of *Ilex Gongonha*. It has an extensive geographical range, being found in the extensive woody regions of Paraguay, watered by the Parana, the Ypane, and Jejni, in the province of the Minas Geraes, and other districts of Brazil; and it appears to have been found in Guiana by M. Martin, as there are numerous specimens in his Herbarium, part of which is in the possession of Mr. Lambert. We must believe these specimens to have been collected in the mountainous district, otherwise it would be impossible to reconcile the idea of the same plant being found in so different a latitude. The tree is about the size of the orange-tree, to which it bears considerable resemblance in its habit and leaves. The flowers are white, disposed in small cymes in the axils of the leaves. They are tetrandrous, and are succeeded by scarlet berries, like those of the common holly. The leaves, whether fresh or dried, are destitute of smell; but, on a little warm water being poured upon them, they exhale an agreeable odour. Mr. Lambert has been so fortunate as to obtain a living plant of this highly interesting tree, which is now growing in his collection at Boyton House, Wilts. In New Holland the leaves of the *Corrœa alba* make very good tea. The inhabitants of those barren and remote islands denominated the Kurile Isles, in the Sea of Kamtschatka, prepare a tea from an undescribed species of *Pedicularis*, named by Professor Pallas in his Herbarium, now in Mr. Lambert's possession, *Pedicularis lanata*. It is unnecessary to take notice of all the aromatic herbs of the order *Labiatœ* used as tea in different countries: my object has been to show that teas are afforded by plants very remotely separated from each other in point of affinity. But while on the subject of teas, it may be interesting to observe, that the common black Chinese Teas consist chiefly of the old leaves of the *Thea viridis*, mixed with those of the *Camellia Sasanqua* or *oleifera*, and sometimes fragments of the leaves of the *Olea fragrans*; and that the finest teas, whether green or black, appear to be produced by the *Thea Bohea*, the quality and colour depending solely on the age of the leaves, and the mode of preparing them. Although I have long attended to the subject, I have never been able to detect, in those teas said to be adulterated, either willow or sloe leaves, or any thing else of British growth. It is probable that the leaves of the species of *Camellia* before mentioned may have been taken for sloe leaves. —*Edin. Phil. Journal.*

SUCCESSFUL CASE OF TRANSFUSION OF BLOOD.

[From the Lancet.]

On Wednesday evening last, at the close of Dr. Blundell's introductory lecture, that gentleman communicated, to a numerous class, another successful case of transfusion of blood into the veins. A woman had lost a large quantity of blood after labour: her life was in imminent danger; and, in fact, from all the symptoms, there was no probability that she could live more than three or four hours. Mr. Doubleday of the Blackfriars-road, who attended her, having read in the Lancet of the operation of transfusion which Dr. Blundell lately performed with success, determined to make a trial of it. He, accordingly, took a quantity of blood from the arm of her husband, and having made an opening into the median vein of the right arm, proceeded to inject the blood with a syringe, in the manner described by Dr. Blundell in the late experiment.

The operation was performed without the least difficulty; and as soon as three charges of the syringe, or six ounces of blood, had been injected, the woman, who was a native of the sister kingdom, expressed her feeling of renewed strength in rather strong terms. The syringe was replenished several times; and upon the whole, fourteen ounces of blood were injected. Mr. Doubleday then very judiciously discontinued the injection, as the patient began to experience a slight pain in the head. The woman shortly after declared that she felt herself well enough to get up and walk.—Not one bad symptom has supervened since the operation.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION VII.—*continued.*

4. *Mr. Tennant's Bleaching Salt, or the Oxymuriate of Lime.*

Lime was impregnated with chlorine for the purposes of bleaching, at an early stage of the improvements we are now detailing, by Watt, Henry, and Cooper, but it does not appear that it was by them brought into their general practice, as they seem to have preferred the simple water, or the oxymuriate of potash. It was reserved for Mr. Charles Tennant of Glasgow, to improve the process of making it so as to render it both a cheap, convenient, and efficacious agent in bleaching.* The first process which he adopted for this purpose, has been already given at page 238, (Vol. III.) He was deprived of the patent he had for the manufacturing of this substance, in consequence of a legal decision in the Court of Session. The loss of his patent stimulated Mr. Tennant to new efforts of ingenious invention, and he succeeded in combining chlorine with lime, in the dry way, which renders it easily portable to any distance at a small expense.† In consequence of this, his business has increased to a prodigious amount, while the bleaching processes have received great improvement. The expense also is greatly lessened, as lime is so much cheaper than the alkalies which used to be consumed for this purpose to a very great amount.*

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* The oxymuriates of barytes and strontites, which were also mentioned in his patent, were found to be too expensive for practical purposes, as the latter substance could not be procured in great quantity, and the former could with difficulty be separated from the sulphuric acid with which it is usually found combined.

† So great is the reduction of expense from this cause, that it was proved upon oath, that, by using oxymuriate of lime, the consumption of ashes, in a single bleaching-green, has been reduced £3000 in value in one year.

The concrete oxymuriate of lime, or Tennant's salt, as it is called by the bleachers, is, when prepared for immediate use, diffused by agitation in a quantity of water. This is allowed to stand for some time, till any insoluble matter contained in the lime is precipitated, and the supernatant liquor remain transparent. The liquor thus clarified, is drawn off and diluted with a considerable proportion of water, when it is ready for the immersion of goods. This salt differs so remarkably from most others, that it cannot be procured from the solution either in a dry mass or in crystals by evaporation; for when such a solution is evaporated, part of the acid escapes, and the rest is mostly converted into muriatic acid; so that, instead of oxymuriate of lime, muriate of lime is obtained. The dry salt can only be obtained by Mr. Tennant's process of using dry lime in the first instance.

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* In order to produce this important agent, the chlorine gas is sent into a receiver, similar to that formerly described, which contains, in a pulverised form, the dry hydrate of lime; that is, lime slacked with the least possible quantity of water. The powder, during the influx of the gas from the distilling apparatus, is continually agitated, and the gas combines with it to a certain amount, or till the hydrate becomes saturated. The salt so formed, is a soft white powder, which possesses little of that intolerable smell so conspicuous in the gas. It is partially soluble in water, and its solution is little different from that obtained by the process in which the combination is formed in the solution of lime in water.

EXTRAORDINARY RISE OF THE RIO DE LA PLATA.

THIS river, as is well known, is flooded at certain periods, and, like the Nile, inundates and fertilizes the country. The Indians then leave their huts and betake themselves to their canoes, in which they float about until the waters have retired. In April, 1793, it happened that a violent wind had heaped up the immense mass of waters of this river to a distance of ten leagues, so that the whole country was submersed, and the bed of the river remained dry, in such a manner that it might be walked over with dry feet. The vessels which had foundered and sunk were all exposed again, and there was found, among others, an English vessel, which had perished in the year 1762. Many people descended into this bed, visited and spoiled the vessels thus laid dry, and returned with their pockets filled with silver and other precious articles which had been buried more than thirty years in the deep. This phenomenon lasted three days, at the expiration of which the wind abated, and the waters returned with fury into their natural bed.

SAFETY STEAM BOAT.

A CORRESPONDENT of the Bristol Mirror concludes an interesting article on the melancholy loss of the Comet, and the dangers to which steam vessels are exposed, with the following suggestions for the construction of a safety steam boat:—

"Why may not every steam vessel be constructed and provided as a life-boat? Many ways of doing this will present themselves to those who are conversant with the subject; but the most simple, and perhaps effectual, is one which the writer of this, several years ago, developed in the Bristol Observer, not thinking of its most appropriate application to steam boats, which, indeed, were not then in general use. This plan consists in dividing the hull of the vessel into three distinct compartments, by firm and tight divisions from side to side, so that should the water gain access to one part of the vessel, it could not penetrate to the next. The objection which was started to this plan, as applied to ships of burden, was, that it would *prevent stowage;* and although it was acknowledged that it might save many ships now lost, yet the objection was held valid. But in steam boats this objection cannot occur, as they are not built for stowage. The very arrangement of the vessel seems almost to point out the plan. The engine part is detached both from the cabin and the steerage. Let these divisions be constructed as strongly as the side of the boat, and caulked in the same manner; and *though her bow or stern should be completely stove in, she would still float*, and afford ample time to save all the lives on board, and perhaps even be found competent to continue the voyage. Such a vessel might be denominated with propriety a *safety steam boat,* and, if started, would infallibly ensure an ample share of the public patronage."

SAFETY GUN.

The Rev. Mr. Sommerville, of Currie, near Edinburgh, has invented a safety-lock, the merits of which cannot be made too extensively known. The contrivance is extremely simple, and may be made intelligible without any diagram. In the back part of the trigger there is a square notch, into which a thin sliding bar or catch is pressed by a spring, and keeps the trigger perfectly immoveable. The sliding bar is concealed within the plate lying under the guard. A handle attached to the sliding bar stands up in front of the guard, in such a manner as apparently to form a part of it. When the gun is presented in order to take aim, the left hand, by a slight pressure—no greater than is naturally employed in bringing the gun to the shoulder—moves the handle of the sliding bar to catch backward; the catch itself recedes from the notch; the trigger, now unlocked, yields to the finger, and the discharge follows. The security which this affords arises, first, from both hands being necessary to work the gun; second, from the mere placing of the hands in the proper position being sufficient to effect the discharge; and third, when the two hands are not placed in the firing position, no possible species of accidental contact can make the lock move, or the gun go off. With Mr. Sommerville's lock, the sportman may travel the whole day with his gun on full cock, with the most complete and entire safety. When he brings his gun home loaded, he has only to screw off the handle of the catch, and though half a score of inquisitive urchins should lay their hands upon the gun, they cannot possibly make it go off.

INSTINCT IN PLANTS.

In order that the seeds of plants should produce and perfect their respective kinds, it is necessary that their shoots should rise to the surface of the earth, to enjoy the benefit of light and air. Now, in whatever direction the eye of a seed, from which germination first radiates, is placed, these shoots ascend equally to the surface, either in curved or straight lines, according as such ascent may be most easily accomplished. Mr. John Hunter sowed a quantity of peas and beans with their eyes placed in different directions, in a tub, which he afterwards inverted, so that the bottom was turned uppermost, while the mould was prevented from falling out by a fine net; and, in order that the under surface might possess a superior stimulus of light and heat to the upper, he placed looking-glasses around the mouth of the tub, in such a way that a much stronger light was reflected upon the inverted mould than that of the direct rays of the sun; while, at the same time, he covered the bottom of the tub with straw and mats, to prevent the mould in this direction from being affected by solar influence. Yet the same instinctive law of ascent prevailed. After waiting a considerable length of time, and perceiving that no shoots had protruded through the lower surfaces of the mould, he examined the contents of the tub, and found that they had all equally pressed upwards, and were making their way through the long column of mould above them, towards the reversed bottom of the vessel; and that where the eyes had been placed downward, the young shoots had turned round so as to take the same direction.

As one experiment leads to another, he determined to try the effect of placing other seeds of the same sort in a tub, to which a rotatory motion should be given, so that every part of it might be equally and alternately uppermost, and the seeds should have no advantage in one direction over another. It might probably have been expected, that the plants, in always seeking to ascend, would have assumed a spiral form, as the same surface was never for any time presented. This, however, was not the case. Instead of ever turning round, the different shoots uniformly adhered to a straight line, except where they met with a pebble or any other resistance, when they made a curve to avoid such obstruction, and then resumed a straight line in the direction in which they were thereby thrown, without ever endeavouring to return to the original path.

A strawberry offset, planted in a patch of sand, will send forth almost the whole of its runners in the direction in which the proper soil lies nearest; and few or none in the line in which it lies most remote.

" When a tree, which requires much moisture," says Mr. Knight, " has sprung up or been planted in a dry soil in the vicinity of water, it has been observed that much the larger portion of its roots has been directed towards the water; and that when a tree of a different species, and which requires a dry soil, has been placed in a similar situation, it has appeared, in the direction given to its roots, to have avoided the water and moist soil."

" When a tree," remarks Dr. Smith, " happens to grow from seed on a wall, (and he particularly alludes to an ash, on which the fact occurred,) it has been observed, on arriving at a certain size, to stop for a while, and send down a shoot to the ground. As soon as this shoot was established in the soil, the tree continued increasing to a large magnitude."

ON A NEW REFLECTING, COMPOUND, AND SINGLE MICROSCOPE IN ONE INSTRUMENT.

Invented by Mr. JOHN CUTHBERT, Optician and Philosophical Instrument Maker.

[From the Technical Repository.]

MR. CUTHBERT, of Bishop's Walk, Lambeth, whose ingenious combination of the hydro-pneumatic blowpipe, and pneumatic trough and tray in one apparatus, and of a gas-holder and pneumatic trough in another, we have already described, has recently favoured us with a sight of the extraordinary effects produced by his new reflecting microscope, and which he originally executed on the plan recommended by Dr. Goring; but which he has now greatly extended, so as to combine the above mentioned three instruments in one.

The reflecting part of this instrument consists of a concave elliptic speculum of six-tenths of an inch focus, and three-tenths diameter, mounted at the farther end of a short conical tube, which is screwed into the cylindrical body of the microscope; near to the concave speculum an aperture is made in the side of the conical tube, through which the image of the object to be viewed is received upon a very small plane diagonal speculum, and by it reflected into the concave speculum, from whence it is transmitted through the body and eye-glasses to the eye of the spectator in a greatly magnified state. Upon the conical tube, a triangular bar is fitted at right angles to it, having a sliding carriage upon it, with a very fine rack and pinion, to adjust it accurately; and to it the carriage or stage, fitted up with a springing plate, to hold the sliders with objects in them to be viewed, can be adjusted; or the stage can be removed, and an improved forceps substituted in their place. Upon the triangular bar, an illuminating concave speculum, mounted in a swinging adjusting frame, can be slided, when required, to concentrate light in viewing transparent objects. And also upon the conical tube, an illuminating lens, mounted in a swinging frame, can be fitted to increase the light in viewing opaque objects; and which, as the object, however highly magnified, never approaches nearer to the conical tube than the tenth part of an inch, can readily be effected.

The cylindrical body of the microscope is received into the cleft jointed socket of the usual telescope stand, fitted up with a binding screw, mounted upon three folding legs, and furnished with a turning joint for changing the position of the body from a horizontal to a vertical one, or any intermediate one at pleasure; the joint is also mounted upon a cylindrical tube, sliding in another, to which the legs are screwed, and thus permitting the body of the instrument to be elevated or depressed, or turned in any horizontal or other direction at pleasure; and as it can also be turned round in the cleft socket, so it admits of every possible variety of position, and can either receive the direct light of the sun, day-light, or of a lamp or candle, as may be eligible; or their reflected light from the speculum.

The magnifying power of this reflecting microscope is considerable, and it is varied and very greatly increased by applying different eye-glasses, as in the astronomical telescope; and, therefore, to render the instrument also equally useful for lesser magnifying powers, Mr. Cuthbert has contrived to remove the reflecting part from the body of the microscope, and to substitute for it, a short tube, into which the usual buttons with object glasses can be screwed, as in the common compound microscope; the adjusting stage and forceps, and the illuminating speculum being also equally applicable to the microscope in this state. And to render the microscope an universal one, he has fitted a ring, with a screw inside of it, to the triangular bar, and the latter to the body of the microscope; and he thus converts it into a simple microscope, or megalascope; the buttons with the object glasses of the compound microscope screwing into the ring, or lenses of less magnifying powers being substituted in place of them.

We certainly have never witnessed such effects produced by any microscope as by Mr. Cuthbert's reflecting one. In some of the most difficult *test* objects, such as the feather of a moth's wing, and the coloured scales of the diamond *curculio;* the minute ribs of the moth's feather and those of the scales of the diamond *curculio* were defined with an accuracy of detail, which we in vain attempted to obtain with an excellent microscope in our possession made by the late scientific Mr. Samuel Varley; and in the hair of a mouse, particularly where the usual microscopes can, at most, only show dark coloured spots, longitudinal wavy lines or furrows were most distinctly visible.

Mr. Cuthbert has at present only fitted up one of these compound microscopes, although he has finished the speculum for three. And it is his intention shortly to grind a concave speculum of only three-tenths of an inch focus, instead of six, as in the present microscope; and by which he will still more extend its magnifying powers, and add greatly to its value in aiding the pursuits of the naturalist, and the scientific inquirer into the minute wonders of the creation.

THE SPHEX, OR ICHNEUMON WASP.

The sphex, or ichneumon wasp, in its perfect state, feeds on the nectary of flowers; but as soon as she is fitted to deposit her eggs, she becomes actuated by a desire of another kind. She first bores a small cylindrical hole in a sandy soil, into which, by accurately turning round and adjusting herself, like the nut-weevil, she also drops an egg. She next seeks out a small green caterpillar, inhabiting the leaves of the cabbage plant, which she punctures with her sting, yet so slightly and delicately as not to kill it; she then rolls it up into a circle, and places it in the sandy nest immediately over the egg. She continues the same labour till she has counted twelve, and deposited twelve caterpillars, one over another; and thus repeats the process of ovation and supply, till she has exhausted herself of her entire stock of eggs. She immediately closes the hole and dies, entrusting her eggs to the fostering heat of the sun. The egg in each separate cell or aperture is soon hatched, and the young *larvæ* finds, in the superincumbent green caterpillar, its food duly prepared, and in waiting for it, and incapable, from its enfeebled state, of resisting its attacks, though preserved from putrefaction by the little life that yet remains to it. It feeds progressively on the twelve caterpillars, and, by the time it has exhausted them, becomes fitted for, and is converted into a chrysalis. In the proper season it awakes from its dormancy, works its way to the surface of the earth, throws off its chrysalid clothing, employs its fresh wings with dexterity, rises into the new element of the atmosphere, feeds on the honey of plants instead of on maggots, and at length, pursues the very same train of actions to provide itself with a progeny, which was pursued by the parent insect that gave it a being.

ON THE EMPLOYMENT AND WORKING OF ANIMAL HORN IN GENERAL.—By M. Vallet.

[Translated from the French.]

Horn, particularly of oxen, cows, goats, and sheep, is a substance soft, tough, semi-transparent, and susceptible of being cut and pressed into a variety of forms; it is this property that distinguishes it from bone. Turtle or tortoise shell seems to be of a nature similar to horn, but instead of an uniform colour, it is variegated with spots.

These valuable properties being known, renders horn susceptible of being employed in a variety of works fit for the turner, comb, and snuff-box maker. The means of softening the horn need not be described, as it is well known to be by warmth, but of the cutting, polishing, and soldering it, so as to make plates of large dimensions, suitable to form a variety of articles, an account may be desirable. The kind of horn most to be preferred, is that of goats and sheep, from its being whiter and more transparent than the horn of any other animal. When horn is wanted in sheets or plates, it must be steeped in water, to be able to separate the pith from the kernel, for about fifteen days in summer, and a month in winter; and when it is soaked, it must be taken out by one end, and well shaken and rubbed, in order to get off the pith; after which it must be put for half an hour in boiling water, and then taken out, and the surface sawed even, lengthways; it must again be put into the boiling water to soften it, so as to render it capable of separating; then with the help of a small iron chisel it can be divided into sheets or leaves. The thick pieces will form three leaves, those which are thin will form only two, whilst young horn, which is only one quarter of an inch thick, will form only one. These plates or leaves must again be put into the boiling water, and when they are sufficiently soft, they must be well worked with a sharp cutting instrument, to render those parts that are thick even and uniform; it must be put once more into the boiling water, and then carried to the press.

At the bottom of the press employed, there must be a strong block, in which is formed a cavity of nine inches square, and of a proportionate depth; the sheets of horn are to be laid within this cavity, in the following manner: at the bottom, first a sheet of hot iron, upon this a sheet of horn, then again a sheet of hot iron, and so on, taking care to place at the top a plate of iron even with the last, and the press must then be screwed down tight.

There is a more expeditious process, at least in part, for reducing the horn into sheets, when it is wanted very even. After having sawed it with a very fine and sharp saw, the pieces must be put into a copper used for the purpose, and there boiled until sufficiently soft, so as to be able to be split with pincers;

then bring quickly the sheets of horn to the press, where they are to be placed in a strong vice, the clasps of which are of iron, and larger than the sheets of horn, and screw the vice as quick and tight as possible; let it then cool in the press or vice, or it is as well to plunge the whole into cold water. The last mode is preferable, because the horn does not dry up in cooling. Now draw out the leaves of horn, and introduce other horn to undergo the same process. The horn so enlarged in pressing, is to be submitted to the action of the saw, which ought to be set in an iron frame, if the horn is wanted to be cut with advantage, in sheets of any desired thickness, which cannot be done without adopting this mode. The thin sheets thus produced, must be kept constantly very warm between the plates of hot iron to preserve their softness. Every leaf must be loaded with a weight heavy enough to prevent its warping. To join the edges of these pieces of horn together, it is necessary to provide strong iron moulds suited to the shape of the article wanted, and to place the pieces in contact with copper plates, or with polished metal surfaces against them; when this is done, the whole should be put into a vice and screwed up tight, then plunged into boiling water, and after some time it is to be removed from thence, and immersed in cold water, which will cause the edges of the horn to cement together, and become perfectly united.

To complete the polish of the horn, the surface must be rubbed with sub-nitrate of bismuth, by the palm of the hand. The process is short and has this advantage—that it makes the horn dry promptly.

When it is wished to spot the horn in imitation of tortoise shell, metallic solution must be employed as follows:—To spot it red, a solution of gold in aqua rigia must be employed; to spot it black, a solution of silver in nitric acid must be used; and for brown, a hot solution of mercury in nitric acid. The right side of the horn must be impregnated with those solutions, and they will assume the colour intended. The brown spots can be produced on the horn by means of a paste made of red lead with a solution of potash, which must be put in pieces on the horn, and subjected some time to the action of heat. The deepness of the brown shades depends upon the quantity of potash used in the paste, and the length of time the mixture lies on the horn. A decoction of Brazil wood, a solution of indigo with sulphuric acid, a decoction of saffron and Barbary tree wood is sometimes used. After having employed these materials, the horn may be left for half a day in a strong solution of vinegar and alum.

In France, Holland, and Austria, the comb-makers and horn turners use the clippings of horn, which are of a whitish yellow, and tortoise shell skins, out of which they make snuff-boxes, powder-horns, and many curious and handsome things. They first soften the horn and shell in boiling water, so as to be able to submit them to the press in iron moulds, and, by the means of heat, form it into one mass. The degree of heat necessary to join the horn clippings must be stronger than that for shell skins, and which can only be attained by experience. The heat must not be too great, for fear of scorching the horn or shell. Considerable care is required in these operations, not to touch the horn with the fingers, nor with any greasy body, because the grease will prevent its joining perfect. Wooden instruments should be used to move them while they are at the fire, and for carrying them to the moulds.

HEALTH AND LONGEVITY.

[Continued from page 224 of the present Volume.]

In the wildest scenes of nature—with the solitary savage of the frightful forest, the shepherd on the bleak and barren hill, the hermit in his unfrequented cell, and the retired peasant of the glade—we endeavour in vain to trace either the inroads of disease, or to find the couch of sickness: we may become acquainted with the traditionary spot where some celebrated chief was butchered, the field where a deadly feud was terminated, or the mountain whence a warlike tribe was expelled; but among the

> " ~~~~~~ hardy sons of rustic toil,"

in vain we search for the records of sickness or disease. In more polished society we are introduced into circles of ostentatious magnificence—variety of splendour; we speed from pleasure to pleasure; we revel in every possible luxury; but the heart sickens at the contemplation of misery, even in the most magnificent palace; ere the period of manhood is attained, the mind is decayed, every noble faculty either utterly destroyed, or perverted to the very worst purposes; the body enfeebled and emaciated; and what might have otherwise been the happiest period of existence, through idleness, pleasure, and luxury, is rendered

> " A life of pain." ~~~~~~

Health, and a lengthened existence, is the natural ambition of every mortal; and, perhaps, it is the greatest blessing we can enjoy in a temporal state. Since, therefore, health and existence is so much to be desired, it must, to every rational creature, appear a matter of necessity, that we exercise the means for the attainment of this coveted treasure. The relation of means to the end, and the necessity of exercising these means for the attainment of the end, is a doctrine obvious to the most casual observer. Health and existence, then, is an end to be attained, and TEMPERANCE is evidently the most proper mean of attaining it. In the time of Cyrus, the Assyrian legislators did not consider the strength of their armies to consist in the number of their soldiers, or in the number, variety, and ponderous quality of their armour; but, more rationally, in the individual strength, spirit, and activity of their troops—both officers and men; and, therefore, they selected the objects of their future hopes from, I may say, the very arms of their mothers; and the whole time of their youth was spent in the schools of discipline, and the initiatory practice of military tactics; they were temperately fed and clothed, inured to every privation, and every attention paid to them, which the greatest possible foresight could suggest; and thus we find them courageous in the field of blood, fearless in danger, equal to the most disheartening journeys, undergoing incredible fatigue, and accomplishing the most successful enterprises: but mark the conclusion of the reign of Cyrus—what a change!—idleness, luxury, and splendour soon undermines constitutions, which neither climate nor hardships once could shake; and he who traces the subsequent history of this people, will find lamentable proofs of the destructive inroads of luxury and of vice. And indeed, but with all deference be it spoken, the histories of Egypt, Greece, Rome, and other nations that were once great on the earth, furnish ample evidence of the degrading influence of luxury. To condescend on particular instances is unnecessary.

On this subject, the author of a certain celebrated treatise remarks:—"There is not perhaps any opinion more universal, nor, if we may credit the testimony of the oldest writers extant, more ancient, than the common one, which supposes a kind of progressive degeneracy in the human race, an unremitting depravation in all the endowments of man, degrading each succession of actors on this great stage, and setting them below their predecessors in every thing valuable, amiable, or great. Every generation complains of its own inferiority in size, vigour, and health, and becomes in its turn an object of admiration to its successor, which, to escape the prospect of debility, deformity, and disease, looks back with rapture to the imaginery pre-eminence of former days." And again, "The families of kings, heroes, and nobles, after dwindling through a short succession of generations, at length totally disappear, their places are supplied from the pasture or the plough, and the new possessor of wealth and dignity entails upon his posterity the joint and inseparable acquisition of opulence and infirmity, luxury and disease. The country, the true *officina gentium*, the great *workshop of humanity*, is continually sending in supplies from her forests and mountains, and despatching her hardy and prolific sons to fill up the chasms of population; while cities and great towns, those immense gulphs in which the redundancies of creation are absorbed, stand open night and day to receive the voluntary victims of disease and death,

> 'Noctes atque dies patet atri janua Ditis.'"

Every candid mind must, and will allow, that, as nature requires but little sustenance, a perseverance, or even an occasional indulgence, in luxury and intemperance, inasmuch as it becomes *contra res natura*, will more or less be the cause of ill health. Nature does not require it, and therefore it is perverting our faculties to purposes diametrically opposed to that for which we enjoy them. Habit, no doubt, may be urged as an excuse, but man is a rational creature, and such habits should be guarded against; and there is no habit but may, by using the necessary means, be ultimately overcome.

> " What least of foreign principles partakes
> Is best."

CURIOSUS.

MISCELLANIES.

Amsterdam Canal.—It may be said, with justice, that Great Britain has outstripped all the other countries of Europe, in what regards the undertaking and execution of public works, in which utility and and grandeur of conception go together. We had been accustomed to consider as unique in its kind, both with respect to its extent, and its other dimensions, our Caledonian Canal, which can carry a large frigate from the North Sea to the west coast of Scotland; but the new Amsterdam Canal, which establishes a direct communication between the ocean and this important place of commerce, surpasses in depth and breadth every thing of the same nature existing in Great Britain. It appears that a frigate of 44 guns has already passed along its whole extent, and it is even capable of receiving vessels of 80 guns. The projected Portsmouth Canal, which is intended to receive vessels of the line, would rival that of Amsterdam as to depth and width, and surpass it in length, in the proportion of a hundred to fifty miles.

Hydraulics.—M. Schwœbel, a mechanic of Strasburg, has invented a singular machine, with a lever, to replace the hydraulic lever, which possesses the double action applicable to all machines moved by water or horses, either for spinning, flour-mills, sawing, forge-bellows, &c. It increases the power of the machine to which it is applied, and, while giving it a more regular movement, fills the place of two horses where four were required: it is also very useful in times of drought, as it will work a machine with half the quantity of water usually required.

Hazel Nuts found in a singular state at a great depth.—A quantity of hazel nuts were lately found in a bog upon the estate of Sir J. Hay, Bart. of Hayston, near Peebles, about eight feet below the surface. On opening them it was found that the kernel in all of them had entirely disappeared, though the membrane which enclosed it, and the nut itself, were as entire as if the nut had been fresh and ripe. By opening the nut carefully, the membrane could be taken out in the form of a perfect bag, without the least opening. The substance of the kernel must therefore have escaped through the membrane and the shell in a gaseous form, or must have passed through them when decomposed or dissolved by water. In some of the nuts that had not arrived at maturity the bag was very small, and was surrounded, as in the fresh nut, with the soft fungous substance which had resisted decay.

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A Committee of Civil Engineers and Practical Mechanics.

> " From labour health, from health contentment springs ;—
> Contentment is the source of every joy ! "

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IMPROVEMENT ON WEAVING BY POWER, &c. ; VAN'S PATENT BLOWING ENGINE.

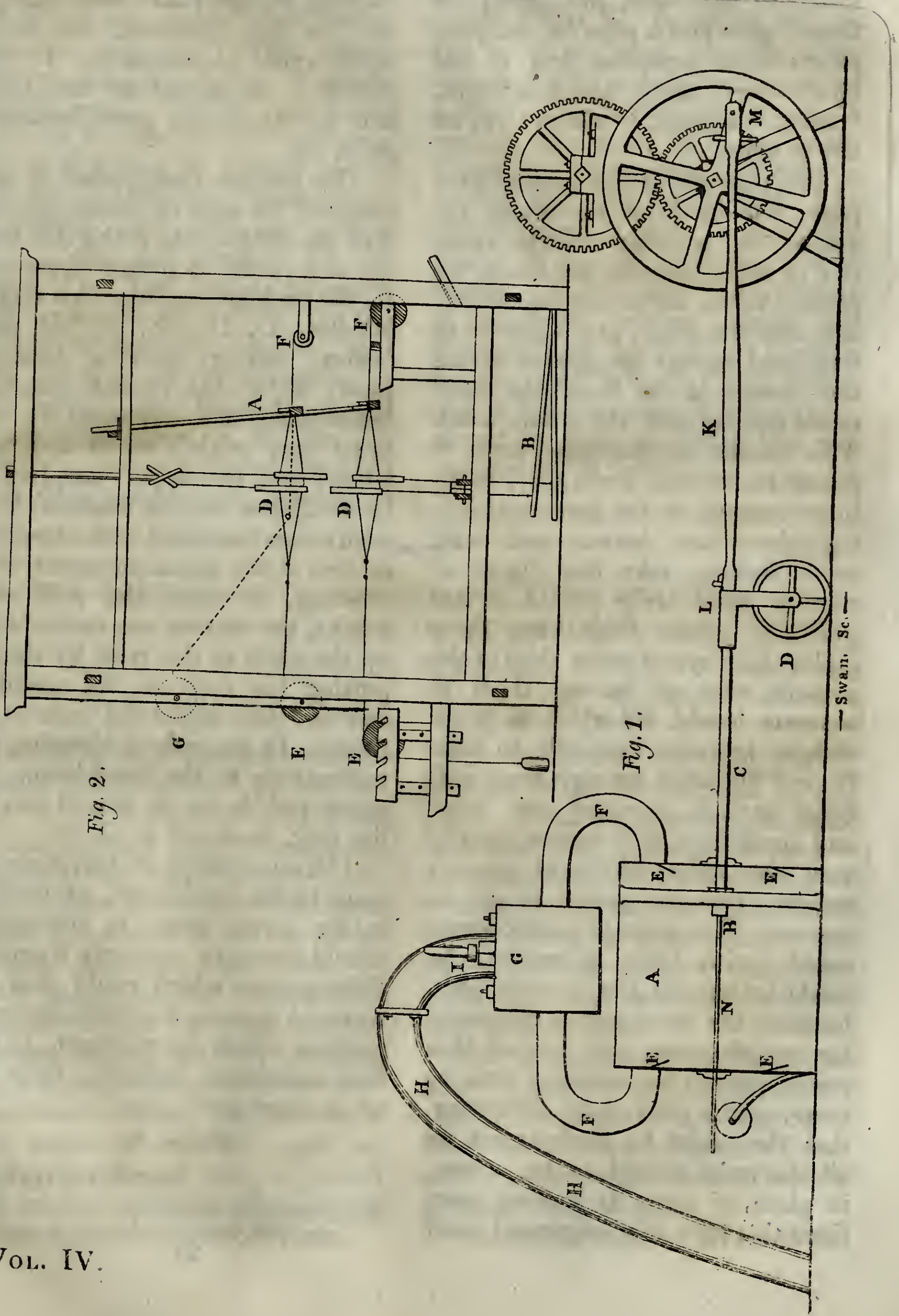

Fig. 2.

Fig. 1.

— Swan. Sc. —

IMPROVEMENT ON POWER-LOOM AND OTHER WEAVING.

Gentlemen,—I send you a few remarks, and a plan which has occurred to me for improving power-loom and other weaving, which, if found to deserve a place in your valuable Magazine, you will oblige me by inserting. I meant to have sent you this at the time I gave you a plan for damping power-loom factories, but it has lain over ever since, and was forgot. I trust, however, it will not yet be out of place.

The plan which I at present propose, is a mode of combining together, or weaving at one time, two or more webs in one loom, by placing them, as in the engraving, one over the other, at a distance so regulated, as that the person having the charge of the loom can command equally well the whole webs. This manner of combining webs in power-looms will, I consider, be an improvement, as the person attending them can better, and with more facility, take the charge of two or more webs placed in this position, where they have them under their eye at once, than in the present way of having them in separate looms, by which they are obliged to turn from side to side. It will likewise prove a most material saving, because one loom and machinery will weave equally well the webs which at present require two or more looms to weave. The present power-looms could, with little alteration, be made to answer the present plan, because the movements necessary for weaving one web are all that are required for weaving two or more,—with this only difference, that they must be made to act on all the webs wished to be woven, in place of one. It is some years since this idea first suggested itself to me; and my idea then was to apply it to the weaving of light fabrics, such as foundation muslins, &c. by the hand-loom; and I took occasion, at the time, to mention it to a few operative weavers. They were very favourable to the practicability of the plan; but liked it not, as they conceived too much work would be produced. It was, therefore, neglected at that time, and the idea, in a great measure, given up.

The manner I suggested at that time will be seen by inspecting fig. 2 of the plate. A, is the lay, having two reeds, at proper distances; B, the treddles working two sets of heddles, D, D; E, E, the yarn beams, having each a separate pace; F, F, the cloth-beams, the lower-most one sustained in the usual way with a catch and rack wheel, and the upper one (which for smallness may be made of iron) with a pace furnished with a treddle; so that at the commencement of a dressing, or when the weft shot breaks, the weaver can easily bring up the cloth to the reed by simply putting his foot on the treddle; and can thus adjust the webs at all times. In the case of dressing the under web in the hand-loom, the upper yarn-beam is moved out of the way, as shown at G.

The advantages of this arrangement in the hand-loom, as well as in the power-loom, is evident, I should conceive, not only from the different sets which could thus be wrought at once, but from the erect position which the workman, in the first mentioned instance, must sit when employed.

Yours, &c.

John Alchorne.

4, South Hanover-Street.
Dec. 16th, 1825.

VAN'S PATENT BLOWING ENGINE.

Fig. 1 of the plate represents this patent blowing engine, which by some is considered superior to the ordinary blowing engine. We are indebted for the drawing to the kindness of Mr. Edington of the Phœnix Foundry, who has one of them in operation at his work. The engine consists of two square boxes, having valves at each end for the admission of the air, in which square pistons move. One of these boxes only can be seen in the engraving, and it is shown in section at A. B is the square piston, which moves backwards and forwards moved by C, the rod running on the wheel, D. The box is provided with valves at E, E, E, E, for the purpose of admitting the air; and thus by the alternate motion of the piston, the blast is forced through the pipes, F, F, into the chest, G; into which also the blast from the other box, which of course is out of view in the engraving, is also forced. A constant blast from the four pipes proceeding from the two boxes, is thus forced into the chest, G, from whence it rushes through the pipe, H, H, to supply the blast to the furnace. I is a loaded valve, placed on the top of the chest, G, by which the air can be let out when the blast is too strong. K is a shaft connected by a joint at L to the piston-rod, C, and having a crank at M, by which it receives motion from any moving power that may be applied. In Mr. Edington's blast furnace, the power is derived from his steam-engine. N is a small rod attached to the piston, passing through the other end of the box, and running on the small wheel, P; by means of this rod the piston is always preserved at right angles to the top and bottom of the chest.

ON THE COMPARATIVE SAFETY OF HIGH AND LOW PRESSURE STEAM ENGINE BOILERS.

By Mr. A. B. Quinby.

[From the American Journal of Science and Arts, Vol. IX.]

The following is the substance of a paper communicated by the author to the Committee appointed by the Literary and Philosophical Society of the city of New-York, to investigate the causes which gave rise to the explosion of the boiler on board the steam boat Ætna.

To determine the comparative eligibility of the *high* and the *low* pressure engine, the two following things appear to me necessary to be considered:—First, the liability of each engine to explode; and, secondly, the danger or injury which each engine is capable of producing in case an explosion takes place.

To determine the comparative liability of the two engines to explode, it will be necessary to consider the four following things:—The diameters of the boilers used in the two engines; the elastic force of the steam in each boiler; the tenacity of the metal of which the boilers are composed; and the thickness of each boiler.

The diameter of the boiler on board the Ætna was thirty inches; and the diameter of a boiler, for a low pressure steam engine of great power, would be about ninety inches, or three times as great.

The elastic force of steam in the

boiler of the Ætna was usually 150 lbs. per square inch; and the elastic force of steam in a *low* pressure boiler is usually 10 lbs. per square inch.

The tenacity of the metal of which boilers are composed is about 60,000 lbs. or six-sevenths of that of good wrought iron.*

As, however, the cylinder which constitutes the boiler is not solid metal, but is composed of plates, riveted together, it will be necessary to diminish the number which expresses the tenacity.

Let, therefore, the tenacity be put at 30,000 lbs. in place of 60,000 lbs.

The thickness of the boiler in the Ætna was three-eighths of an inch; and the thickness of a *low* pressure boiler, for an engine of equal power, would be about one-fourth of an inch.

From these data, it is easy to calculate the comparative liability of the two boilers to explode; for (by mechanics) the force of steam which a *high* pressure boiler, 30 inches in diameter, and three-eighths of an inch thick, is capable of resisting, is equal to the thickness, multiplied by the tenacity of the metal, and divided by half the diameter; $= \frac{3}{8} \times \frac{30,000}{15} = 750$ lbs.; which is 600 lbs. more than the usual working pressure, or five times the usual working pressure.

And, next, the force of steam, which a *low* pressure boiler, ninety inches in diameter, and one-fourth of an inch thick, is capable of resisting, is $= \frac{1}{4} \times \frac{30,000}{45} = 166\frac{1}{2}$ lbs.; which is $156\frac{1}{2}$ lbs. more than the usual working pressure, or $16\frac{1}{2}$ times the usual working pressure.

Hence, if the excesses merely be considered, laying aside the ratio of the elastic force of the steam in the two boilers, it appears that the *high* pressure engine is safer by $443\frac{1}{2}$ lbs. per square inch, than one of the *low* pressure engines. But, on the contrary, if the ratio of the elastic force of the steam in the two boilers be considered, and the excesses be laid aside, it will appear, from the above results, that the *low* pressure engine is more than *three times* as safe as one of the *high* pressure kind; or, that the safety of the *low* pressure boiler is to that of the *high* pressure boiler in the proportion of $16\frac{1}{2}$ to 5.

But it can be shown that either engine can be made entirely safe; and that one kind is not, in fact, any more liable to explode than the other.

To prove this, we have (by mechanics) the thickness of a *low* pressure boiler, 90 inches in diameter, capable of resisting 10 lbs. per square inch $= \frac{45 \times 10}{30,000}, = .105$ inches; and that of a *high* pressure boiler, 30 inches in diameter, capable of resisting 150 lbs. per square inch $= \frac{15 \times 150}{30,000}, = .075$ inches.

And now, if we multiply the first of these results by 10, we shall have .15 inches for the thickness of a *low* pressure boiler, capable of resisting ten times the usual working pressure; which is 90 lbs. above the usual working pressure.

And the thickness of a *high* pressure boiler, capable of resisting ten times the usual working pressure, is $= \frac{15 \times 150 \times 10}{30,000} = .75$ inches; and, lastly, the thickness of a *high* pressure boiler, capable of resisting 90 lbs. per square inch above the usual working pressure, is $= \frac{15 \times 150 + 90}{30{,}000} = 12$ inches.

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* The tenacity of any metal is usually expressed by the greatest weight in lbs. which a bar of that metal is capable of sustaining when pulled endwise.

Hence, as it is fully practicable to make a boiler of a thickness equal to any of the foregoing results, it is plain that one kind of engine may be made just as safe as the other.

I shall merely add, that as the tenacity of metals is diminished by an increase of temperature, the tenacity in the case of the *high* pressure boiler should have been taken something less than in the case of the *low* pressure boiler.

I am, Sir, yours, &c.

A. B. Quinby.

To Professor Silliman.

OBSERVATIONS EXPLANATORY OF A WELL-KNOWN FACT RESPECTING MILK.

By William Maclure, Esq. Surgeon.

[Read before the Glasgow Philosophical Society, 15th January, 1823.]

Gentlemen,

An abstract of the theory which is developed in the following short memoir, found its way into a newspaper soon after it was read; and was copied thence into most of the periodicals both at home and abroad. The readiness and generality with which it was circulated over the whole civilized world, and the absence hitherto of any attempt to controvert it, are strong proofs of the novelty and verisimilitude of the theory; and perhaps may justify my wish to have the whole paper placed on a more permanent record than it has yet obtained. This I authorise you now to do, by affording it an early admission into your respectable Magazine.

I am, Gentlemen,

Your most obedient servant,

Wm. Maclure.

Glasgow, 19th Dec. 1825.

Mr. President,

In the course of my reading on animal physiology, and the chemistry of animal products, I have observed frequent mention to be made of a familiar fact, (which indeed is well-known to every dairy-maid,) but hitherto no successful attempt at its explanation; though it seems to me to be susceptible of a very easy one.

The fact I allude to is, that the milk which is drawn from a cow, or any other quadruped of the class *mammalia*, becomes gradually more rich, as the process of milking draws to an end; and that the last portion which the animal yields, which in Scotland is called *afterings*, or *strippings*, is, in its thickness, taste, and other properties, very similar to cream.

Before giving what I conceive to be the true explanation of this phenomenon, it will be necessary to make an observation or two on the state of milk in the udder after it has been secreted from the blood which is transmitted to that organ; and likewise on the well-known phenomena which are presented by milk after it has been drawn from the cow, allowed to cool, and remain for some time at rest.

With respect to the former of these subjects, namely, the state of milk in the udder after it has been secreted, I observe that, being placed without the pale of the animal's circulation, it remains comparatively, if not absolutely, at rest. It can only be disturbed by the sluggish motions of the animal whilst feeding, or in the actions of rising up and lying down when going to ruminate or sleep. In the next place, its temperature in the udder is probably not at all different from that of the blood in the capillary arteries from which it was secreted, consequently higher than that of the air of our atmosphere during any of the four seasons. Again, the udder is composed of a multitude of lactiferous tubes, placed chiefly in a vertical position, but all converging towards the paps; in each of which a bundle of them terminates in a short canal. These are associated with blood-vessels, nerves, absorbents, and a glandular apparatus, the whole being connected together by a peculiar kind of cellular substance, which, in popular language, is called *lure.* The udder, therefore, besides being a gland for secreting, is also a temporary containing vessel for the secretion; and in this respect it resembles few of the other glands of the body, except perhaps the stomach, and more particularly the *testes.* These are the only facts, relative to the state of milk in the udder, which I think it necessary to mention, in order to prepare the Society for that explanation of the phenomena which has suggested itself to me.

With regard to the other subject, which I judge it of importance to be attended to before presenting the proposed explanation, namely, the appearances which this fluid exhibits after it has been drawn from the animal and permitted to rest in a vessel for some time. Every body knows that it very soon separates into two distinct portions, namely, a thick, yellow or brownish, supernatant part, which is known by the name of *cream;* and a thin, bluish and bulkier part, which in Scotland, after the cream is removed from it, is called *skimmed milk.* The former contains a great deal more oil, or butter, and much less serum, or water, than the latter. It is therefore specifically lighter than the other, and soon rises from all parts of the fluid to the top of the vessel in which the milk is contained, and is readily skimmed or floated off by the careful housewife.

Having premised these particulars, I come now to the main object of this short memoir, which is to explain why milk, in the udder of a cow, becomes gradually richer, or more oleaginous, as the process of milking approaches to a conclusion; and why the last portion which the animal yields, at every repetition of the process, is, in its sensible and other properties, very similar to cream.

Milk, whilst in the lactiferous tubes of the udder, being without the pale of the circulation, and at comparative rest, is in nearly similar circumstances to that contained in a vessel without the body of the cow—so far at least as quiescence is concerned. Its component parts, therefore, will obey the same laws, that is, adjust themselves according to their respective specific gravities, in both states the same, so far as their circumstances are alike. But as, when milk is placed in a vessel without the cow, its oleaginous part, or cream, being specifically lighter than its serous portion, very soon mounts from all parts of the subjacent fluid to the top; so milk within the udder readily separates into two parts; the *afterings*, or oleaginous and lighter part, rising uppermost, and the thinner and heavier part remaining below; which latter being nearest the paps, is the first to be discharged or expressed by the dairy-maid; and the former, namely, the *afterings*, being situated in the upper region of the udder, comes naturally to be the last. The afterings, however, is a good deal thinner than cream, though thicker than common milk. It holds, as it were, a middle rank between these two. This can easily be proved by the Lactometer, and is owing, I presume, to the higher temperature and less perfect rest in which milk in the tubes of the udder must be, compared with that in a vessel out of the cow's body. The heat of the udder keeps the oleaginous part of the milk in a state of greater tenuity, than when it is exposed to the ordinary temperature of the atmosphere, and therefore more readily miscible with the serous portion of it; and the agitation it is exposed to in consequence of the ordinary motions of the animal, renders the separation of the one from the other less complete.

Upon the whole, then, I consider the difference which obtains between what is called afterings and common milk within the cow's udder, to depend upon the very same cause which produces the difference between cream and skimmed milk in the dairy; and therefore, as a corollary to the whole, that were the temperature of the cow's udder the same with that of the surrounding atmosphere, and its state of rest exactly similar to that of a vessel in the dairy, a cow, at the commencement of the milking process, would yield what we call skimmed milk only, and towards the end of it, only pure cream, instead of the agreeable mixture of the two, which we obtain under existing circumstances.

THE BUILDER'S POCKET MANUAL.*

We congratulate our readers on the appearance of another of these valuable little publications, which we have from time to time noticed as publishing by Messrs. Knight and Lacey, at so cheap a rate, for the use of the different trades; and assuredly this one, which is edited by Mr. Smeaton, who has done so much justice to his Edition of Emerson's Mechanics, is not inferior to any of those already in print.

A short enumeration of its contents will best point out its utility. It is divided into two parts: the first part into five sections. Section first contains observations on carpentry, with full instructions on the best modes of choosing, preparing, and preserving timber, and iron work: section second, joinery, in which, besides clear and distinct directions for executing the work, we have a variety of polishes, dyes, oils, and glues, useful to the joiner, and a detail of methods for joining, dove-tailing, morticing, and grooving timber: section third, on masonry; and here we have directions for choosing and preparing the various kinds of stone, observations on the various kinds of masonry, and receipts for preparing cements: section fourth, on bricklaying—a section equally useful with the others, and equally distinct and explicit, and in which we have a great number of receipts for making mortar: section fifth contains a great many receipts of much value to the plasterer, for making stuccos, cements, mastichs, imitations of stone and marble, and compositions. The second part is more theoretical than the first, the contents of which we have thus detailed, and contains a a section on building in general, another on lines; one descriptive of the different orders of architecture; another of the principal terms used in building; and it concludes with a variety of useful tables, with examples of their application.

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* Or, Rules and Instructions in the Art of Carpentry, Joinery, Masonry, and Bricklaying; with Practical Hints and Observations for the Use of the Workman. And a variety of Receipts for Cements, Washes, &c. to which is added, some of the most useful Mechanical Problems, and a variety of Tables, &c. illustrated by several Engravings.—By G. A. Smeaton.—London: Knight & Lacey. Glasgow: W. R. M'Phun. 1825.

The following general observations on carpentry, will give our readers an idea of the execution of the work:—

"In the art of building, the department of the carpenter is distinguished from that of the joiner, in that it regards the substantial parts of the edifice, such as the framing of roofs and partitions, and in fact all that contributes to the solidity and strength of a building; while that of the joiner is more particularly directed to the convenience and ornamental parts: it is hence evident that the carpenter should be well acquainted with the strength and stress of the materials he uses, which are for the most part in great masses; hence he should be careful not to overload his work with timber of greater magnitude than is absolutely necessary, though at the same time, he should also be able to ascertain the dimensions necessary, without weakening the building, and endeavour, by steering a mean course, to produce the maximum of strength, without overloading the several parts of his frames with too much timber; or, by putting too little, endanger the safety of the whole fabric. Thus the art of carpentry depends greatly on these two considerations, *viz.* the strength of the materials, and the stress or strains they are subject to; these strains may be thus—first, laterally, as when a tenon breaks off, or a rafter gives way close to the wall: secondly, the strain may be in its length, when it is drawn down or pushed in its length as a king post, where the strain tends to separate the fibre of the wood by pulling; hence, knowing the strength of the timber to resist such efforts, we are enabled to calculate the dimension necessary to be given it, to resist the probable stress it may have to overcome; all tie-beams are subject to this strain: thirdly, the strain may act by pressure, or the timbers may be compressed in length; this is the case with all pillars, posts, or struts; and in this case, according to the length of the post, &c., it must be of a sufficient diameter to resist the weight which it has to support. Strains are often compound, as a joist or lintel when placed horizontal, or obliquely as in a rafter; or many of these strains may be combined, as in circular or crooked work. All these things are to be particularly attended to; and here I would advise the workman who is anxious to excel in his business, and to confer a lasting obligation on his successors, to make experiments, by trying the strength of timber of different dimensions, and of framings when finished, that something more than theory may in future be his guide, and note down every particular as it occurs; for though it may seem trifling in itself, and a loss of time, yet in the end he will find it of great benefit, not only to himself, but to those who hereafter may be engaged in similar pursuits; and if this method was once to be adopted by the workman, the benefits that would accrue to the art of building would be such as would bring it, with the assistance of men of science, to a state of ultimate perfection.

"The various kinds of timber used amongst carpenters are as follow:—Oak, fir, elm, ash, chesnut, and beech. A few observations on each will perhaps guide him in his selection to appropriate those to the several parts of a building to which they are best adapted; and, first, of Oak:—It is not necessary here to describe this timber, as every carpenter must be acquainted with it; we shall, therefore, only observe, that it is the most ponderous, as well as the hardest grain and firmest texture of any timber used in building; but from its great weight, and difficulty of working, it is but rarely used, except where very great strength is required. In selecting it, however, we should be careful that it is well seasoned, as it is very apt to warp or cast, unless it has been cut at least two or three years; and the workman should be careful not to let any of the sappy parts be used, as they soon decay, and consequently are unfit for the purposes where this timber is required. The next in order is FIR, and this is the most generally useful of any timber for buildings, as we can procure scantlings of much greater dimensions than any other, and it has many advantages, as with a considerable degree of strength it combines a lightness of texture that is highly advantageous; and, also, that it is not subject to cast so much as most other timbers; it possesses a considerable degree of elasticity, and will bend a great deal before its strength becomes perceptibly impaired, consequently very proper for framing of roofs, floorings, &c. and the grain in general runs straight, and where it is sheltered from the vicissitudes of wet and dry, or protected from the weather, it will last a very considerable time; but for those parts of a building that are exposed to the weather, as window frames or sills, door-posts, or any other part where the rain has access, oak is by far the best material, and will endure much longer than any other timber; and for piles, &c. that are constantly under water, it in time gets as hard as ebony, and becomes in appearance like ebony itself; a striking instance of which, we have in those piles called Conway stakes, driven into the bed of the Thames, near Chertsey, in Surrey, supposed in the time of Julius Çæsar, which are of sufficient hardness to be used for purposes to which ebony and other hard woods are applied, such as the stocks and blades of squares, and the heads of guages.

"ELM is a wood but little used in building, being so very liable to twist and warp; it is chiefly used as weather boarding for barns, &c. and in that situation it is found to resist, perhaps as well, or better, than any other wood, the alternate heats of the summer sun, and the rains of a wet winter, particularly when coated with common paint or other composition.

"ASH is a very tough wood, but little used in building, more, perhaps, from the demand among wheel-wrights and millwrights, than from any inferiority to many other woods, as it is not very subject to warp, and is very elastic and tough, as well as of, in general, a straight and even grain.

"CHESNUT is a wood at the present day but little in use for building, though scarcely inferior to oak for many purposes, being extremely durable, and not subject to decay, of generally an even grain, and free from knots or curls, very tough, and of dimensions sufficient for most purposes of carpentry. I have seen beams that have been taken from old buildings of more than a century standing, as sound, and perhaps harder than when first placed in their original situation, and some posts that have formed a part of the same building, that have been always exposed to the different degrees of wet and dry, seemed little or nothing the worse, and, to appearance, as sound as when first the building was erected. They were afterwards worked up in building some small houses in the neighbourhood, and the workmen declared that they thought them even superior to oak, for many purposes.

"BEECH is the last wood I shall here notice, and though but little used in building, it possesses qualities that recommend it for strength, evenness of grain, and toughness; it is not surpassed by any other English timber; but the high price it is usually sold at, for other purposes, make it, perhaps, not so much used as it otherwise would be, and also that if exposed to the action of the atmosphere, it is not found to stand so well as many other woods; it is, however, particularly applicable to sweep work, and is on that account much used by mill-wrights, and might be used to many purposes of building with considerable advantage; it is also particularly adapted for pins in framing and doweling boards together, as it is not brittle or liable to snap, and drives well."

* * *

ON THE COMPARATIVE COST OF POWER OBTAINED BY STEAM OR WATER.

A STEAM ENGINE of twenty horse power, going in Glasgow, on an average of three years, prior to 1824, will cost at the utmost £10 per horse per annum, and in many cases less, including the heating of the mill, in all £200.

Interest on engine, supposing to cost £1500, £75; tear and wear, £40; grease, £26; packing, &c. £4; engine-man's wages, £45: in whole, ...	£390
A water-fall, supposing ten miles from the market (Glasgow), will cost for coals, in heating the mill, £80. Interest on water-wheel, boiler, furnace, &c. supposing to cost £800, £40; tear and wear of water-wheel, boiler, water course, dams and sluices, £30; rent of ground to landlord, £40; carriage of cottons, yarns, oil, paper, iron, &c. £100 per annum; travelling expenses to manager, once a-week in markets, £20 per annum; a man to attend furnace, sluices, and dams, £30: in all, ...	£360
Balance in favour of water, ...	£30

Or, at the rate of £1 10s. per horse power: but this must be more than counterbalanced by the great advance of capital necessary to start such a work in the country, where a village must be built, loss of time in collecting a regular set of workers, with other innumerable inconveniences, which in many instances requires years to accomplish. I court inquiry if in any item I have erred; and I remain, GENTLEMEN, yours, &c.

A PRACTICAL SPINNER.

* * *

NEW IMPROVED SAFETY BOATS AND LIFE BOATS.

[From the Leeds Mercury.]

It has frequently been our pleasing duty to notice meritorious inventions, having, for their object, the safety of our fellow-creatures who traverse the ocean, and the salvation of lives in cases of shipwreck. In laying before our readers a brief account of the improved Boats, on a system contrived by Mr. Andrew Hennessy, of Cork, we feel a more than usual gratification, from a conviction that he has suceeeded in removing many of the hitherto existing obstacles to the formation of a life-boat, which shall be so indestructible as to be available in cases even of the most imminent peril. Mr. Hennessy, of Cork, was regularly bred as a naval architect; he went to sea at an early age, and was one of a few, who, in the shipwreck of a large vessel, was saved from a fearful death. The impression of the awful calamity excited an idea in his youthful mind of constructing a boat, which, not being liable to be stove in, or crushed on rock or wreck, might, in cases of danger, be the means of saving the lives of the crews. He long cherished the expectation of success, and, with such materials as he could procure, tried a number of experiments during the course of his hours of relaxation from his regular employment; but twenty years elapsed before his circumstances enabled him to bring his plans to maturity. The loss of his Majesty's ship Confiance on the coast on which he resided, and the dreadful calamity attending it, at length determined him to devote his whole attention to his favourite and truly benevolent project—for he looked for no remuneration beyond the value of his time, and cheerfully divulged his plans for the benefit of those to whom they might be useful. He constructed a number of models, and proceeded to London in 1822, in the hope of there meeting with patronage and support, which were necessary to complete his designs on a scale which should insure their full success and practical adoption. His models were much admired, but he received no adequate encouragement until they were minutely examined and approved of by the Committee of the Trinity Board, who advised him to persevere, and provided him with the means of procuring proper materials—without which assistance, he gratefully acknowledges he could never have brought his plans to their present improvement. On his return home, he applied himself with new vigour to his task, and after a variety of experiments, conducted at much expense, he completed several small boats, and one of a large size, all of which appear to be impervious alike to the buffetings of the waves, and to the contact with rocks or other bodies, which generally destroy the ordinary life-boat. This grand desideratum is attained by essential novelties in their construction—their ribs or timbers being elastic, and their bottoms and sides covered (we shall not say planked) with a peculiarly strong *cloth*, impenetrable by water. Our readers will require no further proof of the excellence of this kind of vessel than the fact, that the ingenious builder, in company with five seamen, actually sailed in one of them from Cork, on the 7th ult., for England, and was in the channel during one of the late tremendous gales, when his little vessel rode it out in a mountainous sea, with a degree of ease and safety which exceeded his most sanguine expectations. After anchoring at Fishguard, he proceeded to this port, where he arrived on the 15th ult., all well. The boat, which is of the whale-boat model, that being found by experience to be the safest, is about 40 feet in length, and 8 in breadth; she may be of about 20 tons burden; but it may puzzle the Custom-house officers to determine her true admeasurement, for such is her capacity of expansion and contraction, that she may be squeezed up seven or eight feet in length by a sudden shock, and be similarly reduced in breadth. This elasticity constitutes her grand excellence, for a shock which would crush any common boat to pieces, leaves no more impression upon her than a blow does upon a football. Her keel, stem, and stern post, are formed of one piece of timber, steam-bent, and so contrived, that if she were driven, end on, against a pier, it would spring back and deaden the blow. Her ribs or timbers, each of which runs from gunwale to gunwale in a piece, are of white oak, like bows; both on the outer and inner surface of each is a thin lath of whalebone, and they are served or corded in the manner sometimes adopted with coach springs. The beams supporting the deck are attached to a gunwale piece inside, by mortices and iron joints, which admit of expansion or contraction; the deck is merely loose boards; and over the whole, the cloth alluded to, made to fit the model, is tightly laced to the gunwale, and supplies the place both of plank and ceiling. This cloth, which is of Mr. Hennessy's own invention, is a twilled fabric, nearly a quarter of an inch in thickness, a mixture of hemp and wool, prepared by a peculiar process so as to be perfectly water-tight, and not liable to rot or mildew. The inventor has on board several varieties of this cloth, one of which is most ingeniously inwrought with copper, after the manner of the scales of a fish, intended as a specimen for trial on the bottom of a similar elastic boat. The vessel is of the ketch rig; but the cloth, which is stretched, as it were, in ridges on the ribs, offers considerable resistance to the water, and somewhat impedes her sailing. This, however, may easily be remedied by placing thin deals, or laths, longitudinally between the ribs and the canvas. On the forecastle, Mr. H. brought one of his small open boats, made on the same principle, which can be taken to pieces, and the whole folded like a book. The boats may be made of any size; they are susceptible of all the *floating* contrivances applied to other life-boats, with the grand advantage of being impregnable to blows, which so often render other boats useless at the very moment of danger.

It is Mr. Hennessy's intention to proceed by canal, in his little vessel, to London, and afterwards to sail over to Paris; his object being, by exhibiting his boats, and explaining their peculiar construction, (of which our account gives but a feeble idea,) to derive from a generous public the means of defraying the heavy expenses he has incurred in their completion, and of meeting the engagements to which, with a large family depending on his exertions, his enthusiastic labours in this good cause have subjected him.

VIENNA GREEN.

The process for making this esteemed colour is thus described by Dr. Liebig, in a communication to the French Society for the encouragement of the arts and sciences:

Dissolve with heat, in a copper boiler, one part of verdigris in a sufficient quantity of pure vinegar, and add an aqueous solution of one part of white arsenic. During the mixture of these liquids, there commonly forms a dirty green precipitate, which it is necessary, for the beauty of the colour, to make disappear. For this purpose a fresh quantity of vinegar is added till the precipitate is re-dissolved. The mixture is then boiled, and after some time a granulary crystalline precipitate is formed of a most beautiful green colour, which, being separated from the liquid, well washed and dried, is nothing else but the green colour in question.

If the liquor still contains an excess of copper, more arsenic is to be added, and if it contains an excess of arsenic, it is necessary to add more copper, operating in other respects in the same manner. It often happens that the liquor contains an excess of acetic acid; in this case it may be employed anew, for dissolving verdigris.

This colour, thus prepared, has a blueish cast; but in commerce, a deeper and yellower shade is required retaining the same brightness and beauty. To produce this change, it will be sufficient to dissolve a pound of the potash of commerce in a sufficient quantity of water, adding to it ten pounds of the colour obtained by the above process, and heating the whole by a moderate fire. The mass soon deepens in the tint, and takes the shade required. If it be boiled too long, the colour will incline to Scheeles green, but will always surpass it in beauty and brilliancy. The alkaline liquor remaining after this treatment may still serve for preparing Scheeles green, which is a combination of deutoxide of arsenic, and deutoxide of copper.

ON THE ADVANTAGES TO BE DERIVED FROM POPULAR EDUCATION.

[From an Essay on the Education of the People. By James Scott Walker.]

It may seem superfluous to seek for further arguments in support of the utility of popular education. But I would fain impress the conviction, that society loses much by a mere lukewarm approval of such an object. I hold it as an irrefragable axiom, that no nation ever fell into decay by force of its moral acquirements: for it were monstrous to suppose that a country should breathe forth her last sighs in the arms of intelligence. Education can neither be too great nor too general; and there is much of useful talent and of genius which, without the animating light of philosophy, may remain dormant for ever. I would also bring to the recollection of the higher classes, that society owes a large debt to the operatives of England; not only when considered as furnishing, by their skill and industry, a constant supply of all the comforts and elegancies of life, but as having sent from amongst them many of the most valuable and distinguished individuals whose names adorn the national biography of our country. Had our patriots, our poets, our philosophers, been allowed to spring only from the higher orders, England would not yet have reached her present commanding altitude in power and in letters. The various departments of science and learning; the records of the senate, of the bar, of the field, and of the ocean, bear ample testimony to the triumphs of genius, cradled amidst the discouragements of poverty and obscurity. And let no birth-proud lordling look with disdain upon those who have honourably sprung from humble life to high places and distinctions. Genius is alike beneficial to society from whatever class it may arise. The rose may bloom at the door of the cottage, and its perfume is as sweet as if it adorned the more gaudy parterre of the palace. The man of lowly origin, who, by his own intrinsic worth and exertions, contributes to the dignity and happiness of his species, cannot, indeed, boast of hereditary titles—or of the honour of tracing his lineage from some august Saxon marauder, but his is, in the eye of reason. the noblest of all nobility: it is the nobility of genius and philanthropy.

The name of Franklin must be known to all. From the office of a humble journeyman printer, this man rose, by his genius and unwearied perseverance, to be, perhaps, the most distinguished statesman and philosopher of the 18th century. The origin of all his greatness may be dated from the perusal of a few books, to obtain which he submitted even to a sort of starvation. Franklin was a first-rate discoverer in science; but he was more; he was the friend of the human race, one of the great consolidators of his country's independence, and the last public act of his life was to implore that government, which owed him so large a debt of gratitude, to abolish the disgraceful traffic in the human species.

It is a remarkable fact, that most of the celebrated statesmen of the transatlantic states have risen to the highest honours, by the mere force of their education and industry. Mr. Crawford, a late candidate for the Presidential Chair, pursued, for a long time, the humble but honourable vocation of a village school-master.

In our own country, the list of celebrated men who have emerged from lowly life, and contributed to rear the fabric of her glory, is bright and numerous. Shakspeare, that prince of dramatic poetry,—he who "exhausted worlds, and then imagined new,"—was but the son of a wool-comber at Stratford-on-Avon. His fame will live for ever; and it were literary sacrilege to attempt, with feeble pen, to emblazon it here.—Burns, the unrivalled bard of Caledonia, whose verses will be sung when the dialect in which they are written has ceased to be that of his country, was bred to the laborious occupations of the husbandman. To use his own expression, "The Genius of Poetry found him at the plough, and threw her inspiring mantle over him." This great and eccentric poet had an early predilection for books, and the scanty libraries of some gentlemen in the neighbourhood were his eager and grateful resort, and served to cherish to maturity those talents which afterwards shone forth with so much splendour. Scotland owes him much. No man ever did more,—such are the feeling and pathos of his pastorals,—to polish the asperities of rustic life, and imbue it with the most ennobling chivalry and patriotism—the most guiltless devotion to the humanities and hospitalities of life. And while domestic affection and morality,—while the purest attachments of our nature continue to be prized, and while wit and poetry are admired, his " Cotter's Saturday Night," his " Man was made to mourn," and his " Tam O'Shanter," will be read with instruction and delight.

Amongst those of humble origin, whose literary and scientific labours have adorned their country, may be adduced Mr. Gifford, the poet and critic, whose father was but a shoemaker; Bloomfield, author of " The Farmer's Boy," a title which implied his own station in life; Holcroft, the dramatist, and many others. And it may not be irrelevant to mention the name of that highly esteemed and accomplished author and scholar, the self-taught venerable Roscoe, who has done more than any other individual to chasten and promote the literary taste of that huge emporium of commerce, Liverpool, his native town; and whose unremitting labours for the removal of the barbarities of our criminal code, and the improvement of prison discipline, are worthy of the highest meed of the philosopher as well as of the philanthropist.

Of the most humble parentage, was Cooke,* the celebrated circumnavigator. He was the son of a poor cottager in Yorkshire, and was, in early life, inured to the labours of the field. His education was restricted merely to reading and writing, and the first rules of arithmetic. But his own application amply atoned for the scantiness of his early instruction. He served a long and arduous apprenticeship on board of a collier, that practical school of seamanship. He afterwards entered on board a man-of-war, where his bravery, ability, and diligence, so strongly recommended him to his officers, that he was raised to the post of sailing-master, and, soon after, was promoted to a lieutenancy. It was not long before he became a celebrated astronomer and surveyor—and his talents were duly appreciated. He prosecuted three voyages of discovery round the world—in the last of which he unhappily perished in an affray with some of the inhabitants of the Sandwich Islands,* after having enriched his country by the value and the number of his discoveries. The records of his perils and his perseverance will be read for ages yet to come. His death was lamented by the whole civilized world.

Emerson, one of the first mathematicians of his time, and author of many celebrated works, was the son of a poor school-master in Hurworth, in Yorkshire. And Toxteth, in the county of Lancaster, was the birth-place of Jeremiah Horrocks, an eminent astronomer of the seventeenth century. He was the first who predicted and saw the passage of Venus over the sun's disk, a discovery from which he drew many invaluable facts, and from which his successors in the science ascertained the parallax and distance of the sun and planets. His new theory of lunar motions formed the ground-work of the lunar astronomy of Newton, who spoke of him as a genius of the first order. It is worthy of notice, that when this talented man first applied himself to the study of astronomy, his father's circumstances were so embarrassed, that he was destitute of proper books, and other assistance; and those volumes which he could procure were erroneous or obsolete, and led him into mistaken theories. Had public libraries for indigent genius been then established, his studies would have received an earlier impulse; his discoveries would have been pursued with more vigour, and he might have lived to complete that admirable system to which he gave the clue, and which it occupied the time and genius of after-philosophers to mature.

In Lancashire, too, rose the celebrated

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* We have another recent example (amongst many others) in naval annals:—Collingwood, Captain of Lord Nelson's ship, in the battle of Trafalgar, *was a foremast man.*

* The present inhabitants of these islands are docile and harmless, and they have made no small progress in the arts of civilized life. To what is this rapid change to be ascribed? Truly to education—to the instruction they have received from foreigners.

mechanic Arkwright, who, from the most unassuming occupations, advanced himself to usefulness, affluence, and honour. He was an apprentice to a barber in Preston: and from his perseverance and excellent inventions in the machinery for spinning cotton, may, perhaps, be dated the superiority of England as a manufacturing country. Arkwright enriched himself and his family by the honourable application of his talents. He was raised to the honour of knighthood, and died worth a million sterling. By his side we may place the late Mr. Watt, the adapter of that mighty agent of our greatness, the steam engine, to the various purposes of manufacture—and to objects beyond the unaided physical powers of man. Nor must we forget the clever, but poor and neglected, Henry Bell,* who, it is not disputed, was the first who successfully introduced the agency of steam to vessels navigating the waters of Great Britain. And I am here reminded of the observation of a speaker at a late meeting in Glasgow, for promoting subscriptions for a monument to the memory of Mr. Watt, that—"we once had a Primate of England who was the son of a butcher; we now have a Lord Chancellor, who is the son of a coal-dealer, and a Secretary of State, who is the son of a calico-printer."

These are a few only of those men of talent who have struggled through the most disheartening obstacles to fame and distinction; but it would be unjust not to admit that many gifted minds must have sunk under the pressure of poverty—the freezing chill of neglect, and the want of those primary means of instruction, without which genius may linger on into decrepitude, and never become serviceable to mankind. Well may we exclaim, with Beattie,—

> "Ah! who can tell how hard it is to climb
> The steep where Fame's proud temple shines afar;
> Ah! who can tell how many a soul sublime,
> Has felt the influence of malignant star,
> And waged, with fortune, an eternal war;
> Checked by the scoff of pride, by envy's frown,
> And poverty's unconquerable bar,
> In life's low vale, remote, has pined alone,
> Then dropped into a grave, unpitied and unknown!"

LETTERS AND QUERIES.

Gentlemen,—I do not know whether you admit of dreams into your excellent Magazine or not. I suspect the latter; but as I had an uncommon one about a month ago, which was very delightful, and withal quite mechanical, I shall give it to you, along with the cause which produced it, leaving it to yourselves, of course, either to admit or reject it.

I had been attending Dr. Ure's beautiful introductory lecture at the Andersonian Institution, in which he made an allusion to the far-famed lamp of Aladdin; and on my return home, having a slight cold at the time, I took one *stiff tumbler* and went to bed, thinking on what I had heard, and was soon in the arms of "*Murphy,*" who lost no time in presenting me with the lamp. This was beyond my expectations delightful, and quickly calling its powers into action, I resolved to build a temple that should far excel Aladdin's gorgeous palace. Soon the splendid building rose into my view, a noble structure. The centre was circular and of great dimensions, surrounded by a circular colonnade, surmounted by a massive dome, upon which stood a statue on a proper pedestal, I think of Sir Isaac Newton, but I was too far off to see distinctly. Two beautiful wings were attached to this central rotunda, one of which, I was informed, was the Andersonian, and the other the Mechanics' Institutions. While I was gazing at the edifice, people were flocking from all quarters to the central door; and understanding it was to be opened that evening to the public for a small price, I hurried on with the rest, and ascending the stairs, came into the circular gallery, and thence, by one of the doors, into the interior, where I was indeed astonished. It was an interior circular gallery, filled with people, the ceiling being an azure coloured dome, and underneath a similar, but inverted dome, forming together a perfect sphere, studded above and below with the various constellations, and stars of every magnitude transmitting their pale blue lights. In the centre was a large red globe, as the sun, filling the whole space with light. A little in front of the gallery was a large well-painted iron globe, representing the earth revolving on its axis, and travelling slowly round the sun, accompanied by a bright reflecting moon, shedding her fainter rays upon the dark side of the earth, and also showing her own varying phases. Mercury and Venus were likewise in their proper courses, but the other planets were not shown that night. The lecturer stood in the centre, immediately under the sun, and at one time came up to the gallery, and showed various little figures of men, and ships, and sun-dials, &c. which he placed upon the earth's surface. When they were turned to the lower part of the globe, they did not fall off, but stuck fast, owing to the earth's attraction, which amused the ladies very much.

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* While monuments are every where erecting to the memory of the late Mr. Watt; and Parliamentary grants are made to Mr. M'Adam for recent improvements in roads, which have been practised in Scotland for perhaps 50 years,—is nothing to be done for this meritorious man—who has little more than £50 a-year, which is granted him by the Corporation of Glasgow?

After the lecture, soft music was heard at a great distance, which gradually increased till it filled all the space, forming an invisible concert. At this time the sun's lustre was so much diminished, that nothing remained but the faint light of the stars showing "darkness visible." It seemed as if the celestial music came from those distant worlds around. Anon it swelled upon the ear in full chorus, and seemed proceeding from the sun, who now shed his bright lustre all around, making the surrounding stars to "hide their diminished heads," while the circulating planets rolled on their joyous course, producing an effect which was irresistibly grand, and such as I never felt before.

After the oratorio of the Creation (I believe) was over, I went down to see the room where it had been performed, (which I understood to have been constructed in the same manner as the swell of an organ,) but in going past the place where they were counting the money collected, and putting it into a box, the rattling noise they made was so great, that I awoke and every thing was gone except my cold.

Yours, &c.

E. C.

Glasgow, 12th Dec. 1825.

GENTLEMEN,—The public are much indebted to the Mechanics' Magazine for the various modes it points out of detecting the numerous frauds practised in the preparing of various articles for sale. Will you, Gentlemen, through your useful Work, point out a method of detecting lint-seed oil mixed up with whale-oil? The former is now nearly £12 per tun lower than the latter; the consequence is, much of the whale-oil is mixed up with it, to the great prejudice of those who require whale-oil pure and entire. It is also much mixed up with rope-oil, to the great hurt of manufacturers in the woollen line.

Another fraud, which has been practised for some years back on soap, you will also, by the assistance of your numerous readers, be able to inform the public how it may be detected. After the soap is made and taken from the boilers, it is mixed up with water, alum, soda, &c. so as to contain from 15 to 20 per cent. of water more than it should have, which, of course, evaporates very fast, and leaves those who deal in that article great losers before they get it off their hands. If any simple outward mark or appearance could be pointed out as indicative of its being adulterated, whereby the public could be put on their guard, they certainly would be much indebted to you—none more than myself, being an oilman, and a constant reader of your valuable little work.

Leith, 19th December, 1825.

NOTICES TO CORRESPONDENTS.

We have written to Mr. Thomas Anderson, Gallashiels, through the Post Office: his communication will appear in our next.

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CURLL, PRINTER.

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MECHANICS' MAGAZINE,

CONDUCTED BY

A Committee of Civil Engineers and Practical Mechanics.

> " One part, one little part we dimly scan
> Through the dark medium of life's feverish dream,
> Yet dare arraign the whole stupendous plan
> If but that little part incongruous seem ! "

No. CVIII. *Saturday*, 14*th January*, 1826. Price 3*d*.

PERKINS' STEAM GUN, &c.

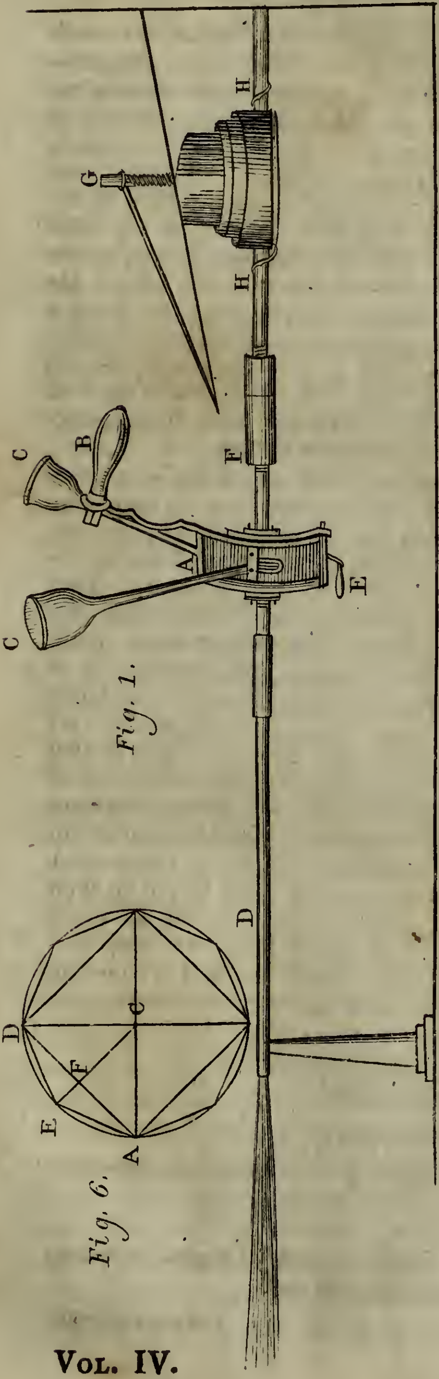
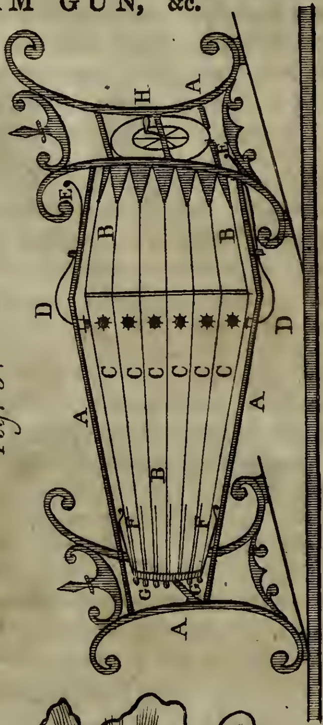


Fig. 1.

Fig. 6.



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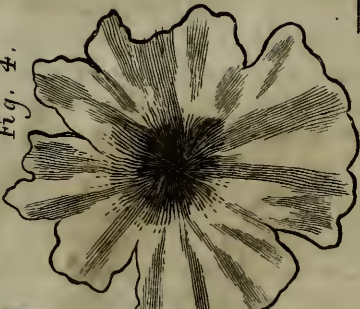

Fig. 4.

Fig. 2.

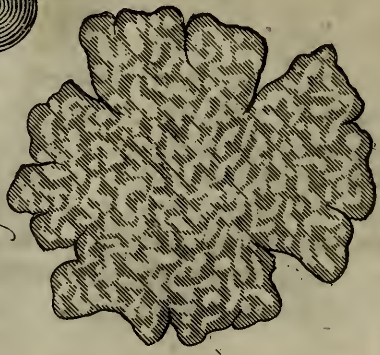

Fig. 3.

Vol. IV.

MR. PERKINS' EXTRAORDINARY STEAM GUN.

Much as may have been said of the power and effects of steam, and great as have been the improvements in steam engines, and in the application of this powerful agent to the purposes of manufacture and the arts, it was reserved for Mr. Perkins to astonish the world with a new application of this agent, even at a time when many were inclined to imagine that the ingenuity of man had exerted itself to the utmost. A recent trial of the steam gun has called the public attention very strongly to it; and has induced us to make up from different sources this account of it. He has long been engaged in perfecting it, but at length he seems to have so far succeeded with this formidable weapon, which, if ultimately adopted, is destined to change the whole system of modern warfare, that the effects of its projectile power, from a musket-bore, and with a lead ball of the usual weight, may be fully judged. A trial was made last month at Mr. Perkins' manufactory, in the Regent's Park, before the Duke of Wellington and Staff, together with the Field Officers of the Engineers and Artillery from Woolwich, most competent to judge from their scientific knowledge. Some preparatory experiments having been made, about the hour of 9 A. M. Mr. Perkins commenced his discharges separately, but at short intervals, against an iron target, at the distance of 35 yards, being the utmost length the court-yard of the manufactory would admit. The bullets were rendered perfectly flat with the lowest pressure employed; and on increasing it, they were shivered to small pieces. Twelve one-inch deal planks, framed in grooves an inch apart, were then opposed to the gun at the same distance, and the ball passed through eleven of them. It was also discharged at a block of wood, against which the utmost force of gunpowder had projected bullets, and it was found equal to all that gunpowder could do. Musket-balls were also sent through an iron plate one-fourth of an inch thick, on which the utmost force of gunpowder had been tried; while that of the steam was not half as high as it was possible to carry it. The pressure used was about 900 lbs. to the square inch, or 65 atmospheres, while it might be carried as high as 200 atmospheres with perfect safety. Hitherto steam had shown its equality with gunpowder in force, and at a hundred times less expense. For example, it would require 250 musket-discharges to project the same number of balls as the steam gun, at a slow rate, say 250 discharges per minute, or 15,000 per hour, which would demand 15,000 charges of powder every hour. The steam gun would do this with 5 bushels of coals. The difference of cost of 15,000 charges of powder, and of 5 bushels of coals, is easily calculated. It next became needful to show wherein this terrible weapon of destruction left all that gunpowder could do far beyond competition. To discharge single balls, a hopper had been filled with them, and they were dropped one by one into the barrel at the breech, as quick as the hand could move a small winch. This winch, with its valve, was now unscrewed, and the barrel communicated with the steam through an apparatus resembling the nave of a wheel, into which it was screwed. A tube, projecting like a single spoke, was screwed into this nave; (numerous radii of the same kind were shown in a model applied to one nave, so that in one revolution each would stand in turn perpendicularly over the gun:) close to the gun it had a valve, above which were fifty-two musket-bullets, and a screw closing the orifice of the tube at the top. This tube being perpendicular, the bullets, on opening the valve, fell into the gun by their own gravity, and were projected one by one, at intervals barely perceptible to the senses, at the rate of 1000 per minute. The roar of the discharge resembled that of the loudest thunder; and the contents of one tube discharged in three or four seconds, afforded the most awful evidence of the power of this mighty fluid that imagination can conceive. After a discharge or two of this kind at the target, in which the balls were shivered to atoms, and the ground strewed with their fragments, a plank of deal about two feet wide, placed horizontally against a brick wall, was fired at, giving the gun a trifling lateral motion at the same time. The bullets perforated the board from end to end, with astonishing regularity, at a few inches only apart from each other, the gun being capable of motion, like the pipe of a fire engine, in any direction. Thus, one musket-bore barrel would, in a second or two, annihilate a company of infantry opposed to it in line, and discharge nearly three times as many balls at once, as a company of ninety men could do with muskets previously loaded:—to re-charge their pieces before such a weapon would be impossible. What, then, could not fifty such guns effect? The astonishing precision with which the balls are projected, each telling within an inch of its predecessor, was exemplified by a discharge against a brick wall 18 inches thick. One discharge literally dug out a hole nearly a foot in diameter, half through its entire thickness, and this with common lead balls only—iron ones would have gone through it. A laudable anxiety has been displayed by Government to avail itself of this tremendous application of steam, and we may now rest assured that it will not be lost. Ten steam cannons would in a field of battle be more than equal to 200 on the present system, and a vessel of only 6 guns would be rendered more than a match for a 74; of 500 balls fired every minute from one of these guns, if only one out of 20 were to reach the mark, ten of such guns would distroy 150,000 men daily. Unfortunately it requires something more than individual property to try the discovery on a large scale. Mr. Perkins should be employed to direct other experiments, and perfect his invention upon the public account, for it is easy to see that this use of steam is yet but in its infancy, giant as it is; and that the expenses of enlarged experiments are more than private property can be expected to sacrifice.

The adoption of the most destructive implements possible in war, must be most friendly to humanity, by shortening its duration. Offensive war will profit much less than defensive. A fort may be made impregnable against an attacking force; and a breach, (could such a thing be made under the fire of steam artillery,) could not be stormed. It is impossible to forsee what changes this discovery may not effect in the history of nations.

Description of the Engraving.

A, (fig. 1,) the chamber of the gun, from which the barrel is charged.

B, the handle which directs the piece working in the chamber, and by means of which the balls are conveyed from the hoppers, C, into the barrel.

C, the hoppers into which the

balls are placed, and from which they drop one by one into the chamber, when the handle, B, is moved to its extent.

D, the barrel, which is about six feet in length.

E, a regulating screw, by means of which the handle is kept tight.

F, a swivel joint, which allows of the gun being elevated or lowered in any point, and by means of which the barrel may be moved in almost any direction.

G, a throttle valve, by which the steam is admitted from the generator of the engine, and into which the pipe communicating with the barrel is introduced.

H, H, Mr. Perkins' admirable mode of uniting pipes, so as to resist any pressure. This represents the junction of the pipe from the generator with that from the chamber.

Fig. 2, the ball before it is placed in the barrel.

Fig. 3, the appearance of the ball on the side nearest to the gun, when discharged against an iron plate on the wall, at the distance of 100 feet from the barrel, and flattened by the force of the concussion.

Fig. 4, the appearance of the ball on the side which strikes against the plate.

NEW MUSICAL INSTRUMENT.

Invented by Mr. Dixon Vallance, Libberton, Lanarkshire.

Gentlemen, — Amongst the great assemblage of useful improvements on machines and instruments which your valuable Magazine exhibits, I have seen no improvements suggested on the violin. I beg, therefore, to present you with one of a novel construction, which resembles the form of a barrel strung all round with ten, or any number of strings, according to the size of the instrument. It is placed in a frame, turns on pivots, and is played by turning it with a handle backwards and forwards, while the strings rub on a bow or bows, which are placed in the frame; strings of different tones rubbing on different bows; the bows are raised from the strings by spring keys to answer the tune.

Description of the Engraving.

Fig. 5 represents the violin placed in the frame; A, A, A, A, the frame; B, B, B, the violin; C, C, C, C, C, C, C, the fiddle strings; D, D, the bows; E, E, E, E, the handles of the bows; F, F, F, F, are the finger springs which fingers the strings when the bows touch them; G, G, are the pins for tightening the strings; H, is the handle for turning the violin. I will give a more detailed account of this new instrument in a future communication; in the meantime,

I am, yours, &c.

Dixon Vallance.

Libberton, Lanarkshire,
28th Dec. 1825.

[We have inserted this new *musical* instrument of our friend Mr. Vallance, although, so far as our own particular ears are concerned, we must say, we would prefer scratching away on our own old-fashioned fiddle.]

FORMULA FOR ASCERTAINING THE CORDS OF A CIRCLE.

Gentlemen,—Having occasion lately to form the segment of a circle of which the required length was one-eighth part of the circumference, I found considerable difficulty in ascertaining the exact length of the cord, without drawing the circle in full, which, owing to its size, was not convenient.

This set me at work to find a rule, by which, having the diameter given, the cord of the octagon might be at once ascertained, and I now send you the following formula, by which the cords both of the fourth and eighth part of the circumference of a circle may be at once found from the diameter. If you think the Rule or its demonstration will be of use to any of the readers of your widely circulated Magazine, either as a rule for practice, or as an incitement to the acquisition of the knowledge by which such formula are obtained, its insertion will oblige

Yours, &c.

T. A.

Gallashiels, 13th Dec. 1825.

Having given the diameter of a circle, to find the cord of its fourth and eighth part, or, which is the same thing, the sides of its inscribed square and octagon,

Rule.—Multiply the diameter by .7071 for the side of the square, and by .38265 for the side of the octagon.

Demonstration.—Let A, B, D, (fig. 6,) be the given circle, its diameter being A, B, the side of the inscribed square, A, D, and the side of the inscribed octagon, E, D.

Put A, B, $= d$; A, D, $= a$; and E, D, $= y$.

Then, as A, C, D, is a right angle, $x^2 = \frac{2\,d^2}{4}$ or $x = \sqrt{\frac{2\,d^2}{4}} = \frac{d}{2}\sqrt{2} = \frac{d}{2}\ 1.414\ 7071\ d$, which is the same as the rule.

Again, because A, F, C, is a right angle, and A, D, bisected in F, we have $\left(\frac{d}{2}\right)^2 - \left(\frac{x}{2}\right)^2 =$ C, F^2, that is $\frac{d^2}{4} - \frac{2\,d^2}{16} =$ C, F^2. Whence, C, F, $= \sqrt{\frac{2\,d^2}{16}} = \frac{d\sqrt{2}}{4}$. But E, F, D, is also a right angle, and E, F, $= \frac{d}{2} - \frac{d\sqrt{2}}{4}$, F, D, also $= \frac{x}{2}$, therefore, $\left(\frac{d}{2} - \frac{d\sqrt{2}}{4}\right)^2 + \left(\frac{x}{2}\right)^2 = y^2$, or $\frac{d^2}{4} - \frac{d^2\sqrt{2}}{4} + \frac{2\,d^2}{16} + \frac{2\,d^2}{16} = y^2$ or $\frac{8\,d^2 - 4\,d\sqrt{2}}{16} = \frac{2\,d^2 - d\sqrt{2}}{4} = y$. Whence, $y = \frac{d}{2}\sqrt{2 - \sqrt{2}} = \frac{d}{2}\sqrt{2 - 1.414213}\ .38265\,d$, the same as the rule.

ON THE MOTION OF FISHES IN SWIMMING.

Gentlemen,—Among the valuable notes which Mr. Smeaton has appended to his excellent edition of Emerson's Mechanics, lately published, I notice the following observations:—

"It has often struck me, in observing the motion of a fish in water, that the air-bladder has other purposes than that of simply rendering it lighter or heavier than the surrounding water, so as to enable it to raise or sink itself at pleasure; for frequently the fish is in a perpendicular direction, either with its head or tail elevated. Now, it is worth inquiry whether the fish has it not in its power to alter its centre of gravity by means of the air-bladder, so that its head or tail shall preponderate; thus enabling it to steer itself in any oblique or even perpendicular direction in the fluid; for by very attentive observation on some gold-fish, in a reservoir, it appeared to me that the action of the tail and fins was insufficient for the purpose, and that they seemed only to use the fins as a means of steadying their position, or balancing themselves; for if the air-bladder itself is capable of but a small movement, either towards the head or tail, it must necessarily cause one end to preponderate, and thus, as it shifts the centre of gravity of the body of the fish, it must produce a corresponding ascent or descent obliquely of the head of it; and thus, by a very simple piece of mechanism, give the fish the means of advancing in any required direction. I am not aware that this idea has occurred to naturalists, but I think, as all nature is subject to mechanical laws, it is worth their consideration, it being foreign to our purpose to enter on the anatomy of the fish, though I think I could show that such a property existed from that consideration."

I should like much to have the opinion of some of your Correspondents on these remarks, and particularly with regard to the anatomy of the fish. So far as my own observation of the motion of fishes in water have gone, (and I have, like many others, amused myself, at times, gazing on the varied sporting and rapid movements of gold-fish in a glass vase,) I should be inclined to differ from Mr. Smeaton entirely in what he says. It has always appeared to me that the change made by the fish, in swimming, from the direct motion to the oblique or perpendicular, was entirely effected by the movements of the fins and tail, and the muscles connected with them. We see with how much ease a man can throw himself on his hands and send his feet into the air, thus entirely reversing his position by the mere exertion of his muscular power; and there is surely no reason to seek for any other cause by which the fish may change from the horizontal to the perpendicular position, and in that shoot away into the waters as it did in its former direction. The fish, when swimming, we may suppose to have a centre of oscillation, as well as a centre of gravity; and as on this it is evidently very delicately balanced, if I may be allowed the expression, it will require little muscular exertion to move on it, and thus to depress or elevate the head. Certainly, however, anatomy would best settle this point, and it is worth inquiring into.

I am, yours, &c.

AN INQUIRER.

Glasgow, 3d January, 1826.

WIDTH OF WAGGON WHEELS, &c.

IT is important to those concerned, that they should be informed that the inconvenience and heavy expense in the alteration of the wheels of waggons, carts, &c. threatened to be imposed by the 3d of Geo. IV. ch. 126, sec. 5 and 6, were repealed by the 4th of Geo. IV. ch.

95, sec. 3 and 4. By the former act it was enacted, that from and after the 1st of January, 1826, the width of the wheels of waggons drawn upon the turnpike road should not be less than three inches, under the penalty of five pounds. Many persons have already anticipated the provisions of this act by having their wheels made in conformity with it, but such was rendered unnecessary by the last act, the restriction, as to width of wheels, being therein repealed; but in order to promote such important advantages to the highways as the use of broad wheels, the 5th section of the last-recited act reduces the tolls after the 1st of January, 1826, upon waggons, &c. *in proportion to the width of the wheels*, viz. every waggon, wain, cart, or other such carriage, having the fellies of the wheels thereof of the breadth or guage of *four and a half inches*, and not *six inches*, at the bottom or sole thereof, the toll payable for such shall be *one-sixth* less than the charge heretofore, and where the width of the fellies shall be *six inches*, *one-third* less shall be taken. The second section of the last act inflicts a penalty of twenty shillings upon the owner, and the like sum upon the driver, for every waggon, wain, cart, or other such carriage, used or drawn on any turnpike road, the nails of the tire or tires of the wheels of which shall not be so counter sunk as not to project beyond *one quarter of an inch* above any part of the surface of such tire or tires. The general width of the farmer's road waggon is sometimes less than three inches, consequently no reduction of toll will be obtained for such; it may, however, be profitable for those who are constantly on the road to take advantage of the act, whilst the farmer will be under no obligation to cast his present wheels aside; the expense now becomes optional, which was before compulsory. The former exemption is continued for carts and carriages of the usual width employed in carrying corn or grain in the straw, hay, straw, fodder, dung, or lime, for the improvement of land, or other manure, or any plough, harrow, or implements of husbandry.—*English Paper.*

SIMPLE CONDENSER.

Gentlemen,—I have often observed, that some people south of the Tweed are very fond of appropriating to themselves the merit of discoveries and inventions, which belong to their more northern, though not less enlightened, neighbours. This has been the case lately in a variety of instances, to one of which I beg leave to direct your attention.

A Correspondent of the London Mechanics' Magazine, (I should have said *The* Mechanics' Magazine,) gives to the world as a new invention of his own, a plan of a condenser for distillation on a small scale, which he has called a Simple Condenser. It consists of two cylinders of tin or copper, the one within the other, with a space of half-an-inch between them: this space is to be closed at top and bottom, leaving small holes for the pipes, one at the top for the entrance of the steam, and another at the bottom for its exit when condensed. This is to be plunged in a cask or puncheon of cold water, and thus the expense of a worm is saved.

It happens, however, unfortunately for the Correspondent of *The* Mechanics' Magazine, that the very same *plan* of a condenser has been in use in this city *for a quarter of a century*, in a much more convenient and useful form. It is every day in use in Anderson's Institution.

In the one belonging to Dr. Ure, (its inventor I know not,) the *whole* is closed at the bottom, and instead of keeping a cumberous cask with cold water in the way, the water is put into the condenser, which thus becomes a common water-can. In order to keep it perfectly cool, a pipe is attached to the inside of the inner cylinder, which reaches nearly to the bottom, having a funnel at the top, by means of which the hot water on the top can be instantly displaced by a supply of cold water sent through the pipe to the bottom. A handle is attached to the top, so that when it is not in use as a condenser, the apparatus can be and is used for many other purposes, such as a pneumatic trough, &c.

The people in this part of the country are not yet so ambitious as to claim public applause for every trifling invention, but when others claim what does not belong to them, they ought to assert their claims.

VERITAS.

GLASGOW MECHANICS' INSTITUTION.

MATHEMATICAL CLASS.

THE Second Session of the Mathematical Class connected with this Intstiution, terminated on Tuesday evening, the 3d January. The concluding lecture was occupied with a brief illustration of the subjects the students have been engaged in, accompanied with several very striking illustrations of their utility. The subjects introduced during the session were, the Elements of Geometry, Trigonometry, Algebra, &c. with their application to the Mensuration of Surfaces, the Mensurations of Heights and Distances, Navigation, the Composition and Resolution of Forces, and the Solution of Questions producing simple and quadratic Equations. At the conclusion of the lecture, Mr. Mackie mentioned the names of a number of individuals who had distinguished themselves in the performance of the exercises which had been prescribed; and as a proof of their industry, stated, that, although the course lasted only about four months, nearly 200 exercises had been given in. Two of the individuals, whose names were mentioned, received premiums, *viz.* Mr. George Kincaid, Gallowgate, 1st Premium; Mr. James Ralston, Gallowgate, 2d do.

[We cannot allow this opportunity to pass without strongly urging the very great benefit which mechanics must acquire from a knowledge of mathematics. We are perfectly sensible that there is not a branch of education which is more entitled to their attention, or which will more amply repay them afterwards, both in an intellectual and pecuniary point of view, for the labour which they may bestow on it. Without a knowledge of mathematics, the mechanic can seldom rise to eminence in his profession; and versant in it there is nothing in his professional career he needs to fear. It is to be regretted, therefore, that so few avail themselves of the excellent opportunities afforded them of acquiring this branch of knowledge. The abstract nature, and the *apparent* inutility of the first principles of the science, seem to terrify them from the study of it; yet remote as at first view some parts of it may appear to be from the business of ordinary life, a more particular inspection of them will convince every one, that although mathematics may not always reach their bosoms, they will seldom fail to find this science come home to their business. We trust to see Mr. Mackie's classes yearly continuing to increase in numbers, which we have indeed little doubt will be the case, as however little he may be given to *assuming honours to himself*, or *trumpeting his own fame*, we know no one more capable or more desirous of doing justice to his pupils than he.]

NEW INVENTION IN THE SCIENCE OF NAVIGATION,

Whereby the Variations of the Magnetic Needle are fully and particularly accounted for, the Causes thereof brought to light, and a clear Remedy pointed out for correcting its deceptions.

By Thomas Johnstone, Fereneze, Barrhead, near Glasgow.

The deviations of the compass, though known to practical gentlemen in the sea-faring line, and to men of science, is a matter with which the public at large is rather unacquainted; and, therefore, before proceeding to show the remedy, it may not be out of place to give a short account of them and of their causes.

It is a universally known fact, that iron has a strong influence on the needle, by attracting it towards the point where it exists; and probably other matter also affects it. As to iron, there is no doubt of its existence, both in known and unknown places; for as in land there is iron stone, and iron ore, there may be rocks of iron stone on the coasts of continents and islands, and perhaps at the bottom of the seas. All these, with the iron in the ship, and in other ships near to it, in their turn, as they are approached unto, alter the bearing of the compass, and the many experiments made at sea confirms this conclusion. The variation and variation of variations which take place, are not by chance, or from any irregularity in the compass itself, but are caused by absolute force and power operating upon it, as it is evidently drawn aside, more or less as it is near or at a distance from magnetic matter. These causes I term terrestrial causes.

It therefore appears, that though the compass is the mariner's guide, it must be a very imperfect one, as it is perpetually liable to be turned aside, and it is a matter of no small regret that hitherto no plan has been discovered by which its aberrations can be perfectly corrected.

Its use in sailing is two-fold; 1st, from it or by it the course is to be formed or shaped; and, 2d, it is by it we are enabled to sail on the course given. In both of these cases, the mariner is liable to be led astray by it, but deception in the first case is the worst or most dangerous of the two. As at correcting the variation, terrestrial causes may have given the compass a very different bearing from what it would have had if not influenced by these causes; and when this is the case, the variation got is false, the correction of it false, and the course fixed on by it also false.—Practical gentlemen in this science have had very great difficulties to struggle with, and great merit is due to them for their laudable exertions, and spirited conduct in braving the dangers attached to their profession. They must have been often disappointed by magnetic deception; as though perfectly versed in the science of navigation, and acting most accurately, according to the most approved authors, and even having much practice and experience, yet, at times they must have made land wide of their port and expectation. This must and does take place at times, and when it does so take place, it is caused by more or less terrestrial attraction intervening when ascertaining the quantity of variation in order to make proper allowance for it at forming the courses, for no place of our globe can be said to a certainty to be free of these terrestrial causes; and, besides, it has been found that electrical matter also attracts the needle. Notwithstanding all this, however, the needle's variations, it appears, still have a superior tendency to the north or south hemisphere, as situated from the equator. From this certain fact, it is evident that a stronger power of attraction than any yet mentioned, exists in these quarters, and that its place or situation is separate and at some distance from the earth. This is proven by experiments made, whereby it is found that the needle assumes different bearings from the same spot of the earth, at different periods of time; whereas, if the cause was in the earth, this could not possibly take place, as all different places of the earth have the same bearings, any one from any other one, that they had from the beginning of time, unless shifted by earthquakes, or other revolutions; so that it is undoubted the principal power of attraction affecting the needle is what I would call a celestial one, or in the atmosphere. And even there it is not as a fixed body, as neither in that case could there be any difference of variation, on any one place of the earth, at different periods of time. From the difference that takes place at sundry periods of time at the same observatory, it is proved that the attracting power revolves in an orbit of its own, performing a revolution every 24 hours, nearly the same as the earth in its diurnal revolution; and that it does revolve, is confirmed by the steadiness of the needle to the same point, throughout the whole 24 hours; whereas if it did not revolve, the needle would undergo the revolution in 24 hours that it takes hundreds of years to perform. If the attracting power was fixed, people on every part of the earth, having a compass, would perceive it in 24 hours changing its variations from none at all, to the greatest quantity naturally on the same parallel of latitude; this would take place by the diurnal revolution of the earth, as thereby every meridian changes place, first with the next to it, and then in succession with the whole round the circle, and the variation not changing is a proof that the cause thereof revolves with the earth. And in daily revolving, it evidently appears that this power takes a very small fraction of time more than the earth in going round its orbit, whereby it losses a very little on the earth daily, so very little that a considerable time elapses before it is perceived, and the unequal velocity causes different variations of the needle, at different periods of time, on the same place of the earth.

(*To be continued.*)

NEW CONSTRUCTION OF BOILER.

Mr. W. H. James, who invented a steam carriage some time ago, is about to introduce a new kind of boiler for generating steam, to be adapted to his improved carriage; it is stated that the experiments which have been tried are extremely satisfactory, and that he entertains no doubt of being able not only to propel his carriage upon ordinary roads which may be nearly level, but also that he shall be enabled to ascend hills that rise three inches in a yard.

He has also lately made some very simple and useful improvements upon rail-roads, and the carriages to be employed thereon, by which he is enabled to pass along curves and turn corners upon the line of railway, without experiencing any increased friction from the drag of the wheels. This is effected by forming the peripheries of the wheels with several elevations, and making those parts of the line of rails where the turns are to be made, to correspond with the wheels, when, by bringing larger diameters of the wheels on one side of the carriage to act upon the rail at the turns, the carriages are made to run in a curved track.

Another part of the invention is a series of train carriages, attached to each other, and drawn by a locomotive engine, having the rotatory power of that engine communicated to the wheels of all the train carriages by a series of rotatory shafts, connected together by universal joints; the advantages of which are, that the moving power is applied to the wheels, so as to make them propel each carriage independently, instead of all being drawn by the first; and likewise that the rotatory power is, by means of the universal joints, communicated through the whole train, even though they are moving in a curved direction, or the shafts forming angles with each other.

MR. SPILSBURY'S PATENT METHOD OF TANNING.

For Mr. Spilsbury's method of tanning, oblong square frames are provided, with metal hoops fastened round their edges. On one of these a skin or hide is stretched, after being limed, cleansed, and prepared in the usual manner for tanning. Over this hide another of the frames is placed, then a second hide is laid above it, and a third frame is put above that. The three frames are arranged so that the metal loops of each shall be opposite those of the others; screw bolts are then put through those loops, and screwed up sufficiently tight to prevent any liquor from passing between the frames and the hides. The whole is then set up edgeways, and there being two short pipes, furnished with cocks, in the upper edge of the middle frame, a pipe, in which there is also a cock, that descends from a cistern holding tan liquor, is fastened to one of these by a union joint; and another cock being placed near the bottom, in the same frame, to let off the liquor when required, completes the whole apparatus.

The cock at the top, that communicates with the tan cistern, being opened, and the other near to it being also opened, while that at the bottom is shut, the tan liquor will run down between the hides, driving out the air at the other open cock; which, as soon as any liquor appears in it, being shut, the tan liquor will then distend the hides, and press outwards, with a force proportional to the height which the tan cistern is elevated above the frames. The consequence of which pressure will be, that the tan liquor will ooze through the pores of the hides, appearing at the outside like dew; and by thus bringing fresh portions to act continually on them, will, in the opinion of the patentee, cause them to be tanned much more speedily than happens in the common method, in which the hides lie in the liquor, after it has ceased to operate on them, and are only passed into fresh liquor at intervals by a tedious manual operation.

The frames are to be made of wood or copper, and if iron should be used for them, it must be well painted, to prevent its making the hides black.

In some cases, two skins or hides may be put at each side of the middle frame; and when the whole are well tanned, the tan cock is to be closed, the liquor is to be run off at the lower cock, and the frames separated from the tan pipe and from each other; and the hides being removed, and having their edges pared off, which were nipped or compressed between the frames, are then to be dried and finished in the usual manner.

Nothing further is stated in the specification respecting the time which this process will require, but that it must depend entirely on the nature of the hides or skins.

The New Repertory of Inventions has the following remarks on the value of this process:

"This method of tanning has attracted much attention; and it is reported that hides of that thickness, to require a year for tanning in the common method, can be finished in this in six weeks; and that some skins can be tanned by it in eight or nine days; it is also said, that a very large sum of money has been offered for the patent right.

"The theory of the process appears to promise well for quick performance, but on these occasions it is necessary to attend to facts; and we have been informed by some gentlemen in the trade, that the hides are not tanned evenly by this method, but leave spots less acted on by the liquor than the rest; and that leather made in this way is not so durable as the common sort.

"The quantity of the hides that must be pared off when they come out of the frames, must certainly diminish the value of the process, and especially when oblong-square frames (such as are represented in the figures of the specification) are used, which, not being of the natural shape of the hides, must cause more waste; which must be worth consideration, even though the parts to be cut away are the least valuable of the hides.

"It must, however, be considered that this method of tanning is still in its infancy, and that it will be probably improved in time, so as to diminish some, and totally remove others, of these objections made to it."

IMPROVED MECHANICAL POWERS.

Dr. Birkbeck, in delivering a lecture lately on the general principles of mechanical science, took a review of the earliest rude specimens of mechanics, and traced their rapid improvement down to the steam engine. He pointed out how the influence of the sun and moon, by changing the elevation of the ocean, had been converted into a mechanical power, and by its means, vessels with their cargoes sunk to the ocean's bed, had been raised to its surface, and restored to the use of man; and he exhibited a drawing of a sunken vessel, to which cables were made fast by means of the diving-bell, and fastened to empty casks on the surface of the water at ebb of tide, by which means, as the tide rose the vessel rose also, and by the flood was floated into shallow water, and brought to shore. He said that there was one combination of power lately arrived in this country, which was completely original, and wonderfully effective. It was the invention of Mr. Dier, a watchmaker in Boston, America. The patent by which he means to secure his great invention is not yet extended to France, which makes some caution necessary in its illustration; but enough could be exhibited to show that it was scarcely possible to imagine that any machine could be constructed more simple or more powerful in equal space. Mr. Dier, the inventor, has applied his contrivance to his own art in clock-making, and had, by its means, constructed clocks with but three wheels, which, with a very small motive power, went twelve months without winding up. The Doctor exhibited one of the clocks, and also one of the machines for raising heavy weights, which consisted of a single wheel of six inches diameter, on a barrel, round which a chain, to which the weight was suspended, was fastened. The wheel had on its periphery fourteen wheels, placed obliquely, which worked in a spiral groove, in a parallel arbour or spindle, which was turned by a handle, and communicating motion to the wheel, and by consequence to the barrel on which the chain was wound, raised the weight. Four pounds on the handle of the spindle balanced four hundred at the end of the chain; and eight pounds completely raised the five hundred pounds.

MECHANICS' INSTITUTIONS.

[From the Edinburgh Review.]

Since we last treated of this most important subject, and endeavoured to administer consolation to the wounded spirit of the High Church party, and other lovers of darkness, many similar establishments have been formed. The desire of knowledge spreads with each effort made to satisfy it. The sacred thirst for science is becoming epidemic; and we look forward to the day when the laws of matter and of mind shall be known to all men; when an acquaintance with them shall no longer be deemed, as heretofore, the distinction of a few superior minds, any more than being able to read or write now constitutes, as it once did, the title to scholarship.

* * * * *

In all, or almost all, the Institutions lately formed, it is truly gratifying to observe the sound principles which have been adopted. The whole body of contributors and subscribers are on the same footing of members and proprietors; the management is entrusted to committees, of which two-thirds, at the least, must be working mechanics; and the funds are, as much as possible, raised by the subscriptions of the working classes, in order to secure the permanency of the Institutions, and to avoid the feeling of dependence. These are the true fundamental principles of this important system. They are all recognised in the rules of the Ashton Establishment now before us; and the last of the three is well commented upon in Mr. Hindley's Address, delivered on the opening of the Institution, June 22, 1825. " You are not (says he) to imagine that this Institution is, in the common acceptation of the word, a CHARITABLE one; that it is an offering, on the part of the rich and the learned, to the poor and ignorant. No! it is an Institution which requires from all its members value received in return for the advantages it offers. The higher classes of society came forward at first to extend the hand of *encouragement*, not of *charity;* and the feeling with which that encouragement is received on the part of the poor, needs have no mixture of the dependence and the shame which is always the companion of the almsman on the rich man's bounty."

The example of the original London Institution has, as might be expected, been followed in the metropolis. Under the auspices of Mr. Gibson, and other most respectable individuals, an Institution has been formed for the Eastern parts of the city, in the Spitalfields districts, and we believe that steps have been taken to establish one in Southwark.

Among the remoter parts of the country, Northumberland certainly stands conspicuous. Mr. Losh, the zealous and enlightened friend of every good work, himself a man filled with various and useful knowledge, and whom an habitual love of classical literature has only made the more anxious for the education of the people—Mr. Turner, who, among the first, years ago opened the doors of his lecture-room to the mechanics, and who is not more distinguished as a pious and learned divine, than as an acute natural philospher; with others, whose names would, had we space, adorn our pages, have so strenuously exerted themselves in this great labour, that we understand there is scarcely a single market-town in the country without a Mechanics' Institution, excepting Afton, and there proceedings have been commenced for founding one. The gratuitous lectures of Mr. Turner, at Newcastle, are very numerously attended by the mechanics, whose attention and regularity are highly commended by the learned professor. How truly *pious* is this discharge of his duty! How greatly to be esteemed, beyond the waste of temper, as well as of precious time, in bootless controversy! How infinitely to be prized, before the base and sordid spirit that seeks emolument by affecting a zeal about civil or ecclesiastical distinction, or licking the dust trodden under the feet of those who hold the keys of preferment!

The suggestions that had been circulated from London through the country, have been effectual to another good purpose—the extension of similar associations to country labourers as well as artizans. Farmers' Book-clubs have been formed in several places; and we trust that the excellent plan of circulating libraries, adopted in East Lothian, that is, libraries which are transferred from one village to another in succession, and used by the inhabitants both of the villages and the neighbouring country, will be imitated elsewhere.

The system, indeed, appears to be working in every direction, and in remote and inconsiderable places. In spring, a beginning was made at Newport, in the Isle of Wight, a town of very moderate size, containing only about 4000 inhabitants. A Tradesman's and Mechanic's Library was formed under very judicious regulations, the subscription being six shillings a-year, or 1s. 6d. per quarter. The number of members soon exceeded 200, and by means of donations, the library in a few months consisted of 500 volumes. There is nothing more useful than to promote the practice of such donations. Almost every man who has a few shelves full of books, has some volume or two useless to him, either as duplicates, early editions, or works the contents of which others present in a better form. The movers in founding an Institution, should bestir themselves to obtain gifts of these books, which are invaluable as the beginning of a library, and of no value to the owners. Lectures have been added at Newport, by the worthy and enlightened Secretary, Mr. Abraham Clarke; and others have signified their intention of taking a similar part. In truth, it requires no professional lecturer to perform this important office. He who has learned—even he who *is learning* chemistry, natural philosophy, or natural history himself, may render the greatest service in explaining those sciences to others who have not the same leisure, or the same command of teachers, books, and apparatus. In the Newport Society, all subscribers are members, and two-thirds of the Committee of Management are mechanics, according to the just principles.

Meanwhile the central establishment in London has flourished beyond the most sanguine expectations of its most enlightened supporters. The foundation of the Theatre was laid about Christmas, and on the 8th of July it was completed and opened by the distinguished founder, Dr. Birkbeck, supported by his Royal Highness the Duke of Sussex, the Marquis of Lansdown, Sir Robert Wilson, Messrs. Brougham, Wood, Hume, Martin, and other zealous friends of popular education, some of whom addressed the meeting after the Doctor had closed his admirable lecture. The premises are spacious and elegant, though perfectly simple, consisting of a commodious house, in which there are large apartments for the library, apparatus, reading-rooms, and the secretary and other officers. The Theatre is a fine and lofty hall, where above a thousand students can easily be accommodated. The lecture of the learned President was a most interesting dissertation upon the advantages of intellectual pursuits, and contained many anecdotes of the shameful ignorance which in former times pervaded all ranks, even the highest in the state. It is to be wished that this discourse, or the substance of it, should be published. both in remembrance of the occasion upon which it was pronounced, and for its instrinsic usefulness. We have called Dr. Birkbeck *the founder of this building;* and well we may, for he advanced the money (several thousand pounds) which purchased the house and erected the Theatre. Other magnificent donations (especially Sir F. Burdett's, of a thousand pounds, and his able, accomplished, and excellent colleague, Mr. Hobhouse, of a hundred,) have been duly appreciated by the country. It is, however, only just to the working mechanics themselves to state, what we have good reason to know, that had no such helps been at hand, they were firmly resolved to raise the needful sums among their own body; and, from their numbers and respectability, there can be no doubt that, in a few months, they would have accomplished this favourite object.

LETTERS AND QUERIES.

Gentlemen,—I should feel much obliged if any of your practical Correspondents would favour me with some information as to the power of the following steam engines for raising water:—

A 30 horse double power condensing engine—cylinder, 30 inches diameter; length of stroke, 4 feet; 16 strokes per minute; depth of pump well, 36 feet; diameter of pump, 16 inches.

A 40 horse double power condensing engine—with the same particulars as above, except that the cylinder is 33 inches diameter.

What quantity of water should each engine send per hour to receptacles, the height of which are severally 60, 120, and 140 feet above the land where the engine is situated, and at a distance of 1½ mile, through an iron main or pipe of 9 or 12 inches diameter? and which diameter of pipe would be most advisable for the benefit of the engines, considering the size of the pump? or should the diameter of the main be equal to, or more than, the diameter of the pump?

I should like to know the principle on which the quantities to the different heights are calculated.

Each engine when at work is supplied by *two* boilers; each of which is calculated for a thirty horse power engine; but only one engine is employed at a time.

What should be the consumption of coal for each engine for 12 hours in performing the work?

By inserting this in your useful publication, you will oblige

Yours, &c.

A Distant Inquirer.

Liverpool, December, 1825.

Gentlemen,—I lately purchased a German flute, the tones of which I found some difficulty in producing, until it was greatly damped by long or frequent playing. This I have removed, however, by giving it two coats of varnish inside; and it now sounds as freely after lying untouched for a long time, as it used to do after being thoroughly swelled. Its tones are likewise greatly improved both in strength and sweetness. If you think this would furnish a hint for improvement to any of your Correspondents, your inserting it will oblige

An Admiring Constant Reader.

Strathaven, 2d January, 1826.

MISCELLANIES.

To Wash Woollen Goods.—The art of washing woollen things so as to prevent them shrinking, is one of the many *desiderata* in domestic economy worthy of being recorded, and it is therefore with satisfaction we now explain this simple process to our readers:—All descriptions of woollen goods should be washed with soap in *very hot water*, and as soon as the article has been cleansed, instantly immerse it in *cold* water; let it be wrung and hung up to dry.

A patent, it is said, has been solicited on the part of T. Steele, Esq. M. A. of Magdalen College, Cambridge, for some very important improvements in the construction and use of the Diving-Bell. This improvement, we hear, particularly attaches to the descent of an engineer, who may remain at any depth beneath the water, and unincommoded by the pressure of condensed air, may work with increased safety and effect, maintaining uninterrupted communication with those above, by means of conversation. Mr. S. has thus invented a plan which will effectually supersede the imperfect and insecure method of signals, made by repeated strokes of a hammer. The same gentleman has, by the employment of optical principles, formed an instrument for the illumination of bodies under water; and also has improved the method of detaching men from the bell.

Moisture in Plants.—The quantity of simple moisture, or rather of pure water which some plants raise from the earth is uncommonly great. This is beautifully exemplified in the organization of some creeping plants, in which the moisture is frequently conveyed the distance of forty, or fifty, or a hundred yards, before it reaches the leaves or fruit, or perhaps the assimilating organs of the vegetable. I have seen a plant of this sort that had been accidentally cut across, continue to pour out pure, limpid, and tasteless water, in such a quantity as to fill a wine-glass in about half an hour.—*Finlayson's Mission to Siam.*

Instruction for Mechanics at Paris.—The celebrated Baron Charles Dupin, of the Institute, has undertaken to give instructions to the industrious classes in geometry and in mechanics, as applied to the arts. His instruction extends to the great manufactures, as well as to the most ordinary and common arts of life, and even to the fine arts. The architect, the carpenter, the mason, the sculptor, the painter, and engraver, each require a knowledge of certain geometrical or mechanical principles: M. Dupin supplies them with this knowledge. The knowledge he teaches is necessary to all mechanics, and artists who have any thing to do with mechanics. In some cities of France some learned Professors have hastened to follow M. Dupin's example, and others propose to follow it. —*French Paper.*

Distance to which Sand and minutely divided Matter may be carried by Wind.—On the morning of the 19th of January last, Mr. Forbes, on board the Clyde East Indiaman, bound to London, in lat. 10° 40′ N. and long. 27° 41′ W. and about 600 miles from the coast of Africa, was surprised to find the sails covered with a brownish sand, the particles of which, being examined by a microscope, appeared extremely minute. At 2 P. M., the same day, some of the sails being unbent, clouds of dust escaped from them on their flapping against the masts. During the night, the wind had blown fresh N. E. by E., and the nearest land to windward was that part of the African coast lying between Cape de Verd and the Gambia. May not the seeds of many plants, found in remote and newly-formed islands, have been thus conveyed?

NOTICES TO CORRESPONDENTS.

We have to request that our Correspondents will be so good as send in their communications on or before the Friday of the week previous to that in which they wish them to appear, otherwise it will be impossible for them to be inserted until the week after. We find it necessary to mention this to prevent disappointment. D. S., Cupar, may write us as often as he pleases; now that we know his writing, his letters will not be refused.

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Communications (post paid) must be addressed.

CURLL, PRINTER.

THE GLASGOW MECHANICS' MAGAZINE,

CONDUCTED BY

A Committee of Civil Engineers and Practical Mechanics.

> " Hath God endowed thee with wisdom? Hath he enlightened thy mind with the knowledge of truth? Communicate it to the ignorant for their instruction; communicate it to the wise for thine own improvement!"

No. CIX. *Saturday, 21st January*, 1826. Price 3*d*.

INSTRUMENT FOR ASCERTAINING THE VARIATIONS OF THE MAGNETIC NEEDLE; NEW IMPERIAL STANDARD MEASURE, &c.

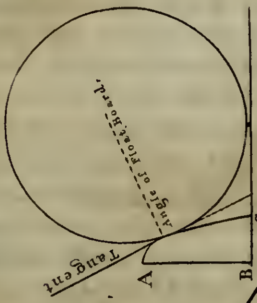

Fig. 2.

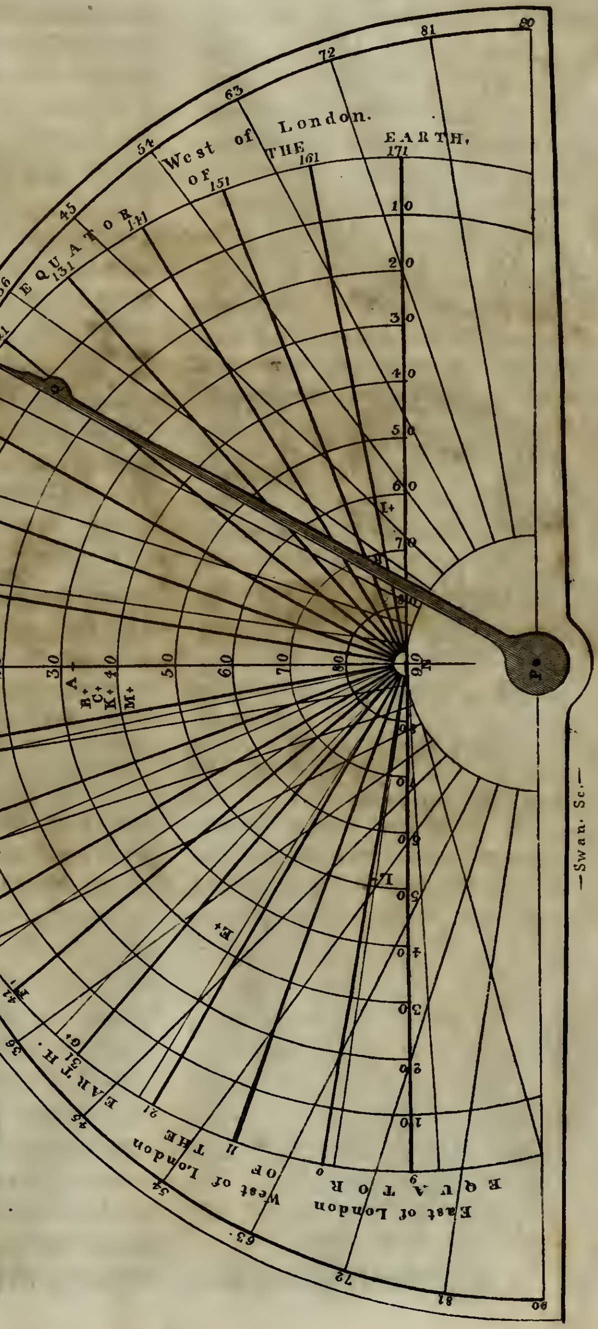

Fig. 1.

—Swan. Sc.—

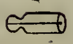

Fig. 4.

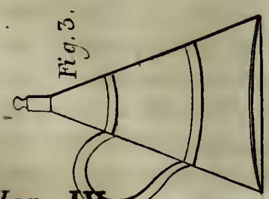

Fig. 3.

NEW INVENTION IN THE SCIENCE OF NAVIGATION,

Whereby the Variations of the Magnetic Needle are fully and particularly accounted for, the Causes thereof brought to light, and a clear Remedy pointed out for correcting its deceptions.

By Thomas Johnstone, Fereneze, Barrhead, near Glasgow.

[Concluded from page 346 of the present Volume.]

From what was stated in last Number, the causes of the different bearings of the magnetic needle were clearly pointed out, so as to be easily comprehended by any ordinary capacity: and we shall now proceed to detail the invention whereby the difficulties and deceptions are to be removed.

By the effects of the magnetic power on the needle where there is no variation, it bears in a direct line to the power, and in that line is the pole of the earth. The distance from the needle to this power is ascertained by another direct line drawn from another place, where the variation is known in point of quantity; and this second line is so drawn as to make an angle with the pole of the earth, to the amount of the quantity of variation on the second place of the earth. The second line extends in space until it intersects or cuts the first line of no variation, and the place or situation of the principal attracting power must be where the junction takes place. Lines drawn from all places of the earth, on one side of the equator to this point, will make angles with the pole of the earth, except when they are drawn from places having no variation, which are only two, 180° distant the one from the other. These angles made with the pole of the earth, are the different quantities of variation, and the true celestial variation, on the different places of the earth and seas.

Now, it is perfectly plain, that, supposing there were no attracting power in all the earth or seas, tables of the celestial variation only, could be constructed from the shape of the earth, and the bearing and distance of the attracting object from the earth, by which the true celestial variation, on all places of the globe, could be shown; and though this cannot be the case, from the abundance of terrestrial attraction existing, yet, having such tables made out, they could be compared with what is given by the compass at shaping courses, and if both should agree, it could be seen that there was no earthly attraction in that place, and the course could be shaped accordingly, by what is thus jointly given. But if the two do not agree, this want of agreement must be caused by terrestrial attraction intervening. In this case, therefore, we must reject all that the compass gives either above or below the tables, and let the course be shaped by the variation given by the tables only. By such means, all the terrestrial attraction in every part of the globe is entirely neutralized and done away. As the tables show the variation at the ship, when its place is known, so they also show the variation at the port, by which means allowance can be made at shaping courses for the difference of variation betwixt the two places. Without the knowledge of the quantity of increasing and decreasing variation, a ship sailing direct on any point, even without any interruption, by adverse winds, must terminate the course either to the one side or the other of the intended port, and it is likely that such deviations have been ascribed to currents, perhaps where none existed. Let it be observed that all this hypothesis is taken from effects and experiments, made both at sea and on land; and it is plain that when the compass is affected by other celestial causes, such as electricity, whether such causes may be many or few, they are all also thus neutralized. Causes are here found out from their effects, discoveries are thereby made which eluded all former researches, and a foundation is laid for ascertaining truth, hitherto unknown.

The system on which the theory is founded, is constant and abiding, not liable to change or fluctuation. Mr. Yates' variation chart shows 24° variation at London, whereas by the distance and bearing of the attracting power from London, the variation there is 28°; supposing, then, Mr. Yates' variation was taken at St. Paul's, which is west from Greenwich, the whole shipping on the river with all the iron connected with them to the eastward of London, and in its vicinity, accounts for the difference; or, if the variation on the chart was taken at Greenwich, the great quantities of iron at Woolwich, also to the eastward, accounts for it; these causes being east, diminishes the true westerly variation. By this present discovery, a true rule is found, for shaping courses. Even, however, when the true course is fixed on, by allowance being made for variation, both at the ship and at the port, yet, it is uncertain, that by sailing on the point fixed on, the ship will come direct to the intended port, as terrestrial attraction on the way may alter the compass, therefore, it must be absolutely necessary to correct the course by the tables at every opportunity of knowing the ship's place; and even if it is only known from information, it will be of advantage, care being taken to correct again when the true observation of the place is got. By the present invention, a new rule in navigation is obtained, which is that of correcting the compass in dark weather, with as much certainty as dead reckoning can be trusted to—a thing never before practised.

The instrument shown in the engraving, (fig. 1,) represents the magnetic sphere, and the sphere of the earth. The earth is shown (as it really is) within the sphere of the magnetic power, with the exception of that part of the equator of the earth which is intersected by the line of no variation, where both equators are one. The instrument represents one-half of the earth, north of the equator, which is one-fourth of the whole globe. The curve forming the outer circle at the top of the instrument is the magnetic equator; the curve next to it, which joins to it at the top of the instrument, is the equator of the earth, which is 23° distant from the magnetic equator, 90° east or west from the meridian of no variation, as the magnetic power is 23° distant from the pole of the earth. By the sphere of the earth being different from the magnetic sphere, the variation of the needle is disproportional and irregular on the different places of the earth. The moveable hand, Q, on the face of the instrument, wherever it is placed, within the magnetic sphere, is itself the magnetic meridian. The lines from the equator of the earth to the centre, N, (which is the pole,) are the meridians of the earth, and the angles these meridians make with each other, are the different quantities of variation caused by the true celestial attracting power, the situation of which is seen at P. The situations of a few places are marked on the face of the instrument; and their true bearings past the pole of the earth, direct to the magnetic power, will be found by placing the wooden hand exactly on said places, and so on for all other places.

Reference to the Engraving, Fig. 1.

A, Savannah river. B, George Town. C, Cape Henry. D, Cuba. E, Madeira. F, St. Thomas' Isle. G, Rocks. H, Ice Cape. I, Cape Mulgrave. K, Philadelphia. L, London. M, New York. N, the Pole of the Earth. P, Centre of Magnetic Power. Q, Handle of the Instrument.

METHOD OF DETERMINING THE VELOCITY OF EFFLUENT WATER, THE CURVE OF THE TURN-HEAD, AND INCLINATION OF THE FLOAT-BOARD OF A BREAST-WHEEL.

Gentlemen,—In this neighbourhood, the falls of water being in general low, it is usual to apply them as a moving power upon what, by mill-wrights, is termed a *breast-wheel.* The water, after leaving the sluice, is made, before striking the wheel, to pass over what is termed a *turn-head*, the shape of which varies according to the head of water employed. The method of determining this shape not having been (so far as I know) treated of, by any of our writers on mechanical subjects, the following problem, with its solution, may not be uninteresting to some of your mechanical subscribers.

Given the head of water; the height of the fall; and the diameter of the water-wheel. To find the velocity of the effluent water, and describe the curve of the turn-head; also to determine the inclination of the float-board of the wheel. The solution, I believe, will be better understood by taking an example. Thus, let the fall be equal to 4 feet 6 inches; head equal to 1 foot 3 inches; diameter of wheel equal to 15 feet. Then, to find the velocity of the effluent water, observe the following rule:—

Extract the square root of the head, and multiply that root by the constant number 5.4, the product will be the velocity of the effluent water per second from below the sluice.

$\sqrt{1.25} = 1.118$, square root of the head; $1.118 \times 5.4 = 6.0372$ feet per second for the velocity of the water from below the sluice.

Then, in order to determine the curve of the turn-head, we must find what space the flowing water will pass through in the same time that a heavy body passes through the fall.

To find in what time a heavy body will pass through the fall, say as the square root of 16 feet, *viz.* 4, is to 1 second, so is the square root of 4 feet 6 inches, *viz.* 2.121, to the time of descent:—4 : 1 : : 2.121 : .53 seconds, time of descent.

Then, to find the space passed over by the flowing water in .53 seconds, say as 1 second is to 6.0372 (the velocity of the flowing water), so is .53 to the space in feet:—1 : 6.0372 : : .53 : 3.199 feet.

Then there is given for the parabola, (fig. 2,) the axis A B = 4 feet 6 inches, and C a point without the axis, and below the vertex, at the distance of 3.199 feet. To describe the parabola passing through that point, part of which, *viz.* that betwixt the vertex and where the circle of the wheel becomes a tangent, constitutes the turn-head—and a tangent to the parabola being drawn from the point of contact of the wheel, and a line drawn at right angles to this tangent, this line gives the angle of the float-board.

The method of drawing the parabola and tangent, from the above data, is described in all the treatises on conic sections, but the most convenient way for drawing the parabola is to determine the length of a number of ordinates, and trace the curve through them by the eye. Should you think the above worthy of insertion in your valuable work, I will probably send you a table of the lengths of ordinates, calculated for all falls from 1 to 16 feet, and for all heads from 6 to 36 inches.

I am, GENTLEMEN, yours, &c.

D. S.

Cupar, 6th Jan. 1826.

AN ACCOUNT OF THE IMPERIAL STANDARD MEASURE,

Made by and for Messrs. J. & H. WARDROP, *No.* 59, *Queen-Street, Glasgow, under the direction of* ANDREW URE, M. D., F. R. S., *Professor in the Andersonian Institution, Glasgow, &c. &c.*

UNDER an impression that the new Act of Parliament, relative to weights and measures, was to come into force in January 1825, I applied to Dr. Ure in the month of November preceding to furnish me with the requisite instructions and *data* for constructing a measure of capacity equal to the Imperial Standard Gallon. He readily and obligingly acceded to my request, informing me that he possessed standard weights made by the celebrated London artist, Mr. Troughton, which would put it in his power to verify the new gallon measure to a single drop, or even less, according to the delicacy of the balance.

In a day or two thereafter, Dr. Ure favoured me with a sketch of a form and dimensions of a standard gallon measure, which I immediately proceeded to get made.

It consists of a hollow cone of copper, the diameter of whose base is to the length of its axis nearly in the proportion of 3 to 4, having its apex, or top, cut off and replaced by a hollow cylinder of brass, about two inches in length, and one inch in diameter. The base of the measure cone is of strong copper, slightly convex upwards, to insure inflexibility of form, and covered (for the sake of protection) with a flat bottom. Into the brass tube orifice of this conical vessel, is accurately fitted a ground brass stopper, having its axis perforated with a hole about one-thirtieth of an inch diameter, widening below into a funnel form, to insure the discharge of every particle of air.

Two fillets or bands of copper are soldered round the surface of the cone, at a little distance from each other, and parallel to its base; these serve to strengthen the sides, and afford means of attaching a handle, by which the vessel can be lifted, when full, without any chance of altering its capacity.

The measure cone thus constructed, was taken to Dr. Ure at the Andersonian Institution lecture room, where he first poised it in the scale of a good balance, and then filled it to the middle of the brass tube, with recently distilled water of the temperature of 62°, by Fahrenheit's thermometer. The stopper was then introduced, and the few drops of water which overflowed through the small bore, were carefully wiped away.

The cone being then replaced in the scale, was found to be heavier by very nearly 70,000 grains, or ten pounds avoirdupois of 7,000 grains each. To this quantity it was exactly brought by very slight adjustments of the brass stopper, and of the interior bottom, till it was finally found to receive and to pour out precisely 70,000 grains of distilled water of the standard temperature.

The inside of the cone having been wrought as smooth and uniform as possible, no more than eight grains weight of water are found to adhere to it, when it is left inverted for a few minutes. Even a compensation was made for this quantity, so that this gallon measure may now be filled and emptied in the dark, (by even a common porter,) and without the chance of committing an error exceeding a single drop or grain out of 70,000.

A sketch of this measure, with the stopper, is exhibited in the plate; fig. 3 is the measure cone complete, and fig. 4 is the perforated brass stopper.

About two months ago, the Hon. Mungo Nutter Campbell, Esq., Lord Provost of Glasgow, and Mr. Cleland, Superintendent of Public Works, and Custodier of the Standard Measures for the City, did me the honour of calling at my place of business, for the purpose of seeing the above measure, which I had kept locked up during the preceding 11 months; when they signified their satisfaction with its general plan and form, and very politely agreed to meet with Dr. Ure and myself next day, in the Hall of Anderson's Institution, in order to verify its accuracy. They accordingly came, accompanied by Dr. Meikleham, Professor of Natural Philosophy in the University of Glasgow, and some other Gentlemen whom the Lord Provost had invited.

After a careful adjustment of weights and balances, the gallon measure was poised, and then filled with distilled water at 62° Fahr.; when it was found to have increased in weight, as nearly as possible, 70,000 grains.

The Hon. the Lord Provost, Professor Meikleham, Mr. Cleland, and the other Gentlemen, expressed themselves perfectly satisfied with the accuracy of the measure.

In consequence of this, until the standard measure shall arrive from London, I hope it will not be considered presumptuous in me to offer to the public those made in conformity to the model of the one in my possession, (adjusted by Dr. Ure,) as deserving their confidence.

Patrick Auld.

59, Queen-Street, Glasgow,
13th January, 1826.

ON THE RECTIFICATION OF ALCOHOL WITHOUT HEAT.

By M. E. Pajot Decharme.

[From the Annales de Chimie.]

Hitherto alcohol, or more properly brandy, could not be rectified, or raised from an inferior to a higher degree, and consequently be brought to a superior state of purity and strength, except by distillation —an operation which could only be effected by an alembic and some heat. The mode of rectification here treated of, can be performed in the cold, and, consequently, without the aid of an alembic or of combustibles. The following, in general, is the method of proceeding:

On the one part, there is poured into a vessel, with a flat bottom, a given quantity of the alcohol, which is desired to be rectified, whether it be small spirits, *(petites eaux,)* proof spirits of Holland, or spirits of a higher degree.

On the other part, one of the most deliquescent salts is to be dried, either muriate of lime, or muriate of manganese: the first is preferable in point of economy, and the superiority of the second gives it a claim to be chosen, but it is less common, and not so easily obtained.

In another vessel of a larger surface, and placed on three or more feet in the vessel which contains the spirits, is to be put the muriate of lime dried and pounded.

This disposition being made, the vessel which holds the alcohol is to be closed up completely, or its edges are to be secured with bands of paper pasted over them, and the whole is to be left in this state for four or five days. After this time the vessel holding the spirits is opened, and that containing the muriate is taken out. This salt is then found to be more or less dissolved, according to the quantity of water which it has attracted. The degree of strength of the spirits is then examined, and it is found to be increased 5, 6, or 8 degrees, according to the fineness of the grain of the dry muriate; it ought not, however, to be too fine, to prevent its becoming pasty, and to make its surface more extensive; the vessel holding the muriate is then cleaned, a new portion of the dry muriate is spread on it, and it is put back into its place, and then the vessel containing the spirits is again shut up in the same manner as before the insertion of this second dose of deliquescent salt.

By operating successively in this manner, highly rectified alcohol is obtained, and weak spirits of 10 or 15 degrees (of Beaumé's areometer) are raised to 40 or 42 degrees.

It may be conceived that this method may be applied to the concentration of various saline fluids, acids, &c. and that by a particular disposition of the factory, basins, &c. it would be easy to establish a rotation, (of the processes,) which, in a given time, would afford, at pleasure, daily products of all degrees of concentration.

M. Decharme is at present employed in trying to give to this process, by the aid of mechanism and natural philosophy, all the regularity, precision, and perfection, desirable for a work on a large scale.

ASCENDING AND DESCENDING HYDROSTATIC CARRIAGE.

A Mr. George F. Reeve, of Orange county, New York, has constructed an engine, which not only exhibits an eccentricity of ingenuity in the inventor, and a pleasing novelty to the beholder, but bids fair to become extensive in its practical utility to the community; the design of the engine is to transport goods or articles by aid of water, any distance, where there is a sufficient quantity and fall for any given distance. Its leading principles consist of a wheel and axis, with floats or buckets, adapted to a race or trough, whose angle of incidence is adapted to the fall, or other circumstantial conveniences. Upon each end of the axis of this wheel is a cog wallow wheel, which works into a rack or cog plate, which is placed upon the top on each side of the race, and which answers for what may not be improperly termed a rail-way. The engine being situated at the foot of the race, and the water let in, and operating upon the floats, turns the wheel, and by the wallow cog-wheels of the axis of the water-wheel being geared with the rack on the race, the wheel ascends; and by a more or less partial supply of water, the water-wheel is made to descend with the velocity required. To the engine may be attached any formation or construction of a carriage, adapted to the nature of the articles intended to be transported.—*Philadelphia Am. Daily Ad.*

APPLICATION OF THE SLIDING-RULE TO FACILITATE CALCULATIONS OF THE STRENGTH OF MATERIALS.

[From the Repertory of Inventions.]

It does not appear to be very generally known, that the common sliding-rule can be applied to form a table of the breadths and depths of a series of beams of equal strength; and, as the operation of setting the rule for this purpose is very simple, perhaps you will have the goodness to place it before your readers.

The common sliding-rule has four lines of numbers, marked A, B, C, D. To prepare for the operation, invert the slider so that the line B is next the line D; then let the given beam be 2 inches in breadth, and 8 inches in depth. Set 8 on D to 2 on B, and the line B will show the breadths, and opposite each breadth on B, the corresponding depth will be found on D, so that the beam may be of equal strength.

Also, supposing it to have been found by calculation that the breadth, multiplied into the square of the depth, should be a known number, as 125, then set 125 on B to 1 on D, and the lines B and D become a table of breadths and depths. When the depth is the same as the breadth, the number is the cube root of 125, or of the number set to unity on D: in this case it is 5.

By means of Mr. Bevan's sliding-rule, a table of breadths and depths for beams or bars, of equal stiffness, may be exhibited. Thus, insert the slider E, inverted, between the lines A and D, and E becomes a line of breadths, and D a line of depths for beams of equal stiffness. If it be desired to know the breadth of a beam 10 inches deep, so that it shall be equally as stiff as a beam 8 inches square, set 8 on E to 8 on D, and opposite 10 on D we have 4.1 on E, which is the breadth required.

When the number on E is equal to the opposite one on D, the number is the fourth root of the number on E, which is opposite to 1 on D. Hence we have a means of knowing the fourth root of any number at once by inspection.

The sliding-rule is already a most useful pocket companion for those who have intricate calculations to make, when there is neither time nor opportunity to refer to tables; and if these few hints add any thing to its utility, it will afford considerable pleasure to your most obedient,

T——.

ON WATER-WHEELS.

In the case of small waterfalls and a large supply of water, undershot wheels are usually employed. But since so much of the power of the water is inefficient in the case of undershot wheels, the whole effect scarcely exceeding the third of the whole force of the water, an important object would be gained, if the construction of the overshot wheel could be adapted to these circumstances. In the case of overshot wheels, it is obvious that a portion of the fall is lost equal to the breadth of the buckets. There is, therefore, an advantage in making the buckets as narrow as circumstances will admit. But, then, their depth remaining the same, their length, and also that of the axle of the wheel, would require to be proportionally increased, and, therefore, the axis would require to be supported at the middle or at proper intervals, which could easily be done by dividing the wheel into several portions. With this construction, and a slower motion given to the wheel, the overshot wheel would perhaps be found superior to the undershot wheel. It would be unnecessary to repeat experiments with wheels of the usual construction after the very accurate experiments of Smeaton, who found that the greatest effect of the overshot wheel was produced when the velocity of the wheel was between 2 and 6 feet per second; smaller wheels requiring the greater, and larger the smaller velocity. But this maximum effect he found never to exceed two-thirds of the whole power of the stream, or the weight raised in a given time to a height equal to that of the fall was only two-thirds of the weight of the water expended. The experiment would require to be made with a wheel unincumbered by any train of machinery, as Smeaton's experiments were likely made under the same circumstances. The water usually enters the buckets with a velocity equal to that of the wheel, and there must therefore be a portion of the fall lost in producing this velocity; for instance, if the velocity be 8 feet per second, 1 foot of the fall is lost; which, in the case of a fall of 6 feet, would be equal to one-sixth of the whole power. The canal ought also to be as nearly a dead level as possible, as the velocity is so much retarded by resistance from the bottom and sides of the canal, whereas the resistance at the waterfall is much less.

When the fall is very small, the diameter of the wheel might be made considerably larger.

In the case of a fall of 30 feet or so, it might perhaps be an advantage to have two water-wheels, the one placed immediately over the other, the lower wheel receiving the water from the upper, and both connected with the same machinery.

I am, yours, &c.

A. B.

Dollar, 9th Jan. 1826.

MR. JACOB PERKINS' IMPROVEMENTS IN PROPELLING VESSELS.

In Mr. Perkins' method of impelling vessels, flat paddles or impellers, like the blades of oars, are made to revolve behind the stern of the vessel, in a plane at right angles to the keel; and from being sloped so as to form inclined planes to the line of impulse, they tend to move the vessel in the opposite direction to that in which their faces act on the water. To prevent the oblique impulse from turning round the vessel, two sets of these paddles are made to move in opposite directions at the same time, and are, of course, attached to separate axles, which, to prevent any projection of the paddles beyond the sides of the vessel, are made to revolve concentrically, by one of them being hollow, and the other passing through and turning round within it. On each of these axles Mr. P. only employs two paddles opposite to one another, whose slopes, or inclined planes, are so curved, that, close to the axle, they form an angle of forty-five degrees with it, while, at their extremities, the angle of inclination is twenty-two and a half degeees. One end of the solid axle on which the other is sustained, lies inside the stern, and its other end is supported by a cross piece that rests on the ends of two long levers which run along the side of the vessel, and turn on pivots placed exactly in a line with the inner extremity of the solid axle, which axle is supported by a cylindrical piece of metal, capable of moving in its socket or bed, so as to admit of the outer end of the axle being raised or lowered by the motion of the levers and cross bars, by which operation the depth to which the paddles shall descend into the water is regulated. To receive the requisite motion from the steam engine, or other moving power, the solid and the hollow shaft have each a mitre-wheel at their inner extremities, near the cylindrical piece, by which the former is supported, and through which it passes a few inches, to allow of the mitre-wheel at its end being at the same distance from the cylindrical piece as the wheel on the hollow axle is at the opposite side. Two other mitre-wheels are placed at right angles to those, with their teeth mutually interlocking, but turning freely on their axles, the ends of which move in the cylindrical piece that sustains the solid axle of the paddles. On the same axle with these two latter mitre-wheels two spoke-wheels are fixed, which connect the axles with the moving power, and which, while they turn round with those axles, are capable of being moved sideways to or from the last mentioned mitre-wheels, so as to be united or separated from them as required, by projecting pieces attached to them for that purpose, in the manner common in mills for similar effects. A metal frame passes outside those spoke-wheels, and moves in grooves in the bosses which connect them with the axles, so that when it is drawn to one side by a screw placed there for that use, and turned by a winch, the mitre-wheel at the opposite side is joined to the moving machinery, and the other one turns loosely in the axle; and when the screw is turned the other way, the mitre-wheel, which was before loose, comes into action, and that formerly in action becomes loose; by which means the direction of the motion of the paddles may be quickly reversed, and the vessel made to go backwards or forwards as required.

Mathematicians have long been in favour of propelling vessels by inclined planes, and in 1752, Dan. Bernouilli obtained a premium from the Academy of Sciences at Paris, for a method of doing this by rotatory inclined planes; accounts of which and of some others may be seen in the Retrospect of Philosophical Inventions, &c. vol. 1, page 243. We are inclined, however, to give the preference to Mr. Perkins' plan, from its superior practical arrangements, but feel somewhat apprehensive that he places the two sets of paddles rather too close together, by which the action of one set on the water may be diminished by that of the other set.

* * *

ON NAVAL IMPROVEMENT.—By Colonel Beaufoy, F. R. S.

[From the Annals of Philosophy.]

The building of three experimental vessels for the improvement of naval architecture having excited much attention in the public mind, not only from the peculiarly interesting nature of the science under inquiry, but from the professional abilities of the different projectors, the individual success of each ship has been observed with an anxiety commensurate with the importance of the object in view.

If, notwithstanding the skill of the constructors, neither of these men-of-war showed decided superiority in sailing, the failure must be attributed to our ignorance of the resistance bodies meet with when opposed to the impulse of water. Our knowledge of this branch of physics is nearly as limited as our acquaintance with the laws which govern the motion of the fixed stars; but here the parallel must end: the accumulated industry of ages alone will probably detect the cause which produces change of place amongst these heavenly bodies, whereas the advancement of hydrodynamics is within the influence of the present generation.

If strength, durability, and efficiency, be all that is required in our floating fortresses, these characteristics have already been combined by the talent of Sir Robert Seppings.

It appears that much uncertainty existed in the sailing of the experimental vessels; sometimes one had the advantage, sometimes another; the distinction resting mainly on the quantity and stowage of the ballast, alterations in the masts, yards, &c. The requisiteness of these changes is a proof that the highest genius is incapable of correctly anticipating either the qualities or the sailing powers of a ship prior to her going to sea.

One great point has been gained by building these vessels, in showing that the synthetical process is inadequate to obtain the end in view. Is it not similar to a chemist, who, desiring to analyse metals, of which some were known and others unknown, first mixed them altogether, and then, after great pains, labour, and expense, discovered the impossibility of arriving at any accurate conclusion in regard to their respective properties; whereas, had he, in the first instance, separately examined each, the result would have proved less fatiguing, less costly, and more satisfactory? In all complex cases, scientific or mechanical, the most easy and natural way for well understanding the subject, is to resolve it into the component parts.

In the construction of ships, the great and leading features are stability and fast sailing; the theory of the former is sufficiently known, but our acquaintance with the resistance of non-elastic fluids may be termed yet in its infancy. The ablest builder is at present ignorant of the curves best adapted for dividing the water; and working thus in the dark, it is no wonder that the aggregate of slow sailers so far exceeds those that are fast.

The importance of discovering the curve of least resistance is not confined alone to vessels moved by the power of wind. Constructors of steam boats are deeply interested in the fact. If a packet with an engine of forty horse power be driven nine knots in an hour, it will require an effort of nearly sixty-one horses to increase the speed to ten. Could this additional mile be gained, by giving the hull a more advantageous form for cleaving the water, many substantial benefits would accrue. The original cost of the engine would be lowered from the inferior size required, expenditure in fuel and stowage would be saved, and less risk incurred of the melting of the grate bars. In short, from the waterman who plies upon the Thames, to the captain commanding the largest ship in the British Navy, all are interested in finding the solid of least resistance; the first by diminishing the labour of the oar, and the latter by out-sailing, coming up with, and capturing the enemy's ships.

Ships have been aptly compared to bridges connecting the whole world together; a slow-sailing vessel, therefore, is a bridge longer than necessary. It is not improbable that the Carthaginian and Roman builders surpassed the moderns in the form they gave their men-of-war for cleaving the water, because, being frequently impelled by oars, to lighten the fatigue of the rowers, must have been a matter of the greatest moment.

It is highly gratifying to observe the pleasure that several of the nobility and gentry take in maritime concerns. The Royal Yacht Club, by building vessels, and bestowing prizes on the best sailers, enjoy the patriotic and praiseworthy consciousness, that money so expended encourages some of the most useful classes of society, and creates a spirit of emulation among the different branches of artificers connected with nautical affairs. This institution, by introducing for trial new and expensive machinery, is capable of performing services which few individuals could undertake; and it is submitted for the consideration of the body, whether considerable improvement in the science of sailing might not result from the following experiments.

Lug-sails are usually thought preferable to others in turning to windward, and such as are taunt and narrow are deemed more effective than those that are low and square; but this phrase of taunt and narrow is extremely indefinite. In the first instance, it is proposed that a vessel, rigged as a lugger, shall sail with others, and most likely one amongst them will be found either a company-keeper, or whose rate is nearly on a par. In the next place, let canvas be taken from the breadth of the sails and added to the hoist, and a second comparison made; thus subjecting the sails to repeated alterations and trials, until the maximum of the length to the breadth be obtained. This fact established, the next suggestion is, to convert the lugger into a cutter, observing the necessary precaution, that the mainsail, foresail, and jib, expose the same surface to the action of the wind as the sails of the lugger. The third trial consists in changing the same vessel into a schooner, scrupulous regard being paid that the quantity of sail is equal in the three cases, and that no variation in the weight, quantity, or stowage of the ballast, be permitted either in the boat of comparison, or experimental vessel.

Rigid adherence to these points is essential to the success of the experiments, inasmuch as it is the action of sails, and not the best trim of the hull, which forms the object of the present inquiry. A vessel of size is for several reasons desirable; one of 14 feet beam, and 57 on deck, might prove sufficiently large; but the beams of the deck should be so disposed as to require no removal in the subsequent alterations of the masts for the various modes of rigging. It is also recommended that the body be clencher-built; vessels so constructed generally excel in sailing such as are carvel made; and this superiority will obtain so long as the resistance of water to curved lines shall be involved in obscurity.

It is somewhat paradoxical that constructors of boats for contraband trade should possess such decided advantage over the builders employed by the revenue, as to call forth an Act of Parliament, regulating the extent and the fixing of the bowsprit, and limiting the proportions which the breadth of a vessel must bear to its length.—Such legislative interference is detrimental to science: experience teaches us, that attempts to run goods will continue, so long as high duties create the temptation; and the boat restrictions, instead of mitigating the evil, have but caused the removal of the capital and skill of the constructors from our own coasts to those of Holland. If a smuggler build a lugger 13 feet beam, 96 from stem to stern, and the bowsprit 60 feet long, why not launch a custom vessel 100 feet in length? the smuggler, if chased, would use his best endeavours to escape; the revenue officer, actuated by duty and stimulated by hope, would exert his utmost to make a seizure, and the relative success of either party would soon determine the most effective limits of length to breadth.

Let not these remarks be misconstrued into an advocation of illicit trade. Taxes must be raised, and consequently any person who by smuggling evades paying his individual share, commits a fraud on the rest of the community, by binding on others the obligation of his own debts. My sole wish is, that naval science may not be injured by legal enactments. On the same principle that laws are made for building and fitting of vessels, why should not others pass, restricting residents on the coast, suspected of contraband addictions, to the services of none but lame horses; whereas all such as are fleet should be devoted to the use of those engaged in the collection of the revenue.

ADDRESS DELIVERED BY THOMAS CAMPBELL, Esq. AT A MEETING FOR INSTITUTING THE WESTERN SCIENTIFIC INSTITUTION, LONDON.

Mr. Chairman and Gentlemen.—I rise to second this proposition with a deep conviction of its public usefulness. Having been invited to take a share in the proceedings of this evening, I feel that I should have been wanting in my duty to you, as fellow-citizens—in my zeal as a lover of letters—and in the demonstration of my orthodox faith, as to the beneficial influence of science and literature on public happiness and morality, if I had coldly omitted to attempt doing the little that may be in my power towards promoting an establishment, the object of which is to promote the intellectual cultivation of an important and numerous class of the minds of this metropolis. Since I first heard of this proposed Institution, I have never ceased, for one moment, to consider it at once commendable in its motives, and practicable in its objects; and I am much deceived, if I am wrong, in hailing it as a prognostic of advantages that will outlive our own generation. It is a fresh mark, that the desire of knowledge is germinating fast and widely in the field of public opinion. It is one of the vernal promises of an intellectual harvest that will ultimately cover the whole domain of society. [*Applause.*] Gentlemen, I am loath to intermix a single remark, personally regarding myself, with the opinions which I express on a subject of so much public importance. But my motive for doing so, is my anxiety to show that my ardent good wishes for the success of this establishment are perfectly consistent with opinions which I uttered before I knew that your Institution was contemplated, and I throw myself on your momentary indulgence for making this explanation. In urging the plan of a London University, of which, if it succeeds, I shall ask for no better epitaph on my grave, than to have been one of its successful instigators, I declared my belief, that institutions of the kind now proposed could never constitute the sufficient means of public education for youth; and I believe so still, as firmly as ever. But let no man deduce from hence that institutions of this nature are not fraught with noble and most desirable advantages. No; the truth only amounts to this, that such institutions cannot answer the purpose of universities, not being in their nature intended to be available for such purposes. The education of an university ought to be adapted to the management of youth who cannot manage themselves. It implies authority and responsibility, and the power of examination on the part of the teachers, and it involves many particulars that could not enter into your scheme. It is no inconsistency, therefore, on the part of the most strenuous advocate for a London University, to wish that institutions like this may increase and prosper. Welcome, I say, be your success; it will expand and corroborate the desire for mental improvement. Most welcome be your chairs to be filled with able and eloquent teachers. They will be wholesome rivals to those of our university; for who knows not that competition is the parent of all excellence? [*Applause.*] No; the literary institutions of London will be no impediment to her university; on the contrary, they will be so many redoubts and flanking towers around the great fortress of public instruction.—Gentlemen, if the remarks which are made in this room were to go no further than among ourselves, it would be wholly unnecessary for me to say one word about certain prejudices that exist, not only against institutions of this sort, but against the general diffusion of reading and information. Your being assembled here, is a proof and a consequence of your despising such prejudices. But we are deliberating as we ought to do under the cognizance of the public, and it is right that we should leave no prejudice unrefuted which even mistaken opinion may allege against our undertaking. I regret to say, that objections against the popular diffusion of knowledge are not confined, as we might expect them to be, to that scandalous part of the press which feeds on warfare with liberal principles, nor to the nightmen and scavengers of our slavish periodical literature—but that they are uttered by men whom we are bound in charity to suppose well-meaning, though they are mistaken. I hold in my hand an authentic printed quotation from an essay on this subject, by Dr. Whittaker,—a name not unknown to the public, who, in speaking of public libraries, says, public libraries corrupt public principles. And why? because there are such things as bad books. But I demand if bad books be not quite as likely to find their way into private as into public libraries? [*Hear!*]—Ay, and a great deal more likely; for there is no check on the admission of impure books into a private library, but the feelings of its possessor; whereas there are an hundred checks in public libraries! [*Applause*]—and there is every chance of their having numerous and most vigilant censors. Well, then, if public libraries, guarded as they are, are to corrupt the public, surely private libraries are still more in danger of corrupting individuals. But this argument proves too much to prove any thing. It militates against books themselves—against the press universally—against the very invention of writing. What, then, because there may be bad books, shall we abjure reading? Because the fire may burn us, shall we not light our fires? Must we put down steam engines, lest their boilers should burst? But public libraries, according to Dr. Whittaker, threaten not only to corrupt public principle, but to depress the dignity of learned professions, and of learned men. Indeed! and a glorious account of their dignity this is to give. Assuredly the diffusion of knowledge tends to pull down pedantry and false pretension. But what is the learned man, who can only be pre-eminent because the society around him is dark and illiterate? What is he better than a giant among dwarfs, or a cyclops among the blind? [*Applause*]—Then as to public libraries being unpropitious to scholarship and deep thinking, what, in the name of reason, can be said to substantiate this wild allegation? Every man engaged in any thing like research must consult many rare and ponderous works, which, unless he be very rich, it would be ruinous for him to purchase collectively. But what is then to injure his style or reasoning in the treasures of a public library, that give him *facta* and *data* for reflection, not to be found in a private one? No doubt a private select library is one of the most charming consolations of life. But public libraries enables us to make our private ones more select, by saving the necessity for including works that are only to be consulted occasionally. Moreover, the booksellers will attest that public libraries diffuse a taste for possessing private ones, and, what is better, they instruct and guide men in the formation of them; for where can we better learn to select the best books, than in places where we can see and compare them numerously? But, fellow-citizens, the rise of so many institutions for the diffusion of knowledge is a feature of novelty in the aspect of the present times. Let us look, however, at this novelty in the face, and let us see if it be a "spirit of health, or goblin damned." And who shall tell me that it is not an auspicious spirit? There was a time when the almost only solace of the active London citizen was the tavern, the card-table, the catch-club, or the theatre. God forbid that I should blame innocent dissipation! A man may taste of the stream without plunging into it. But how much more manly, how much more allied to temperance, and how much more worthy of the proud and solid character of Englishmen, are the intellectual enjoyments which you propose to make popular? Your object is not to further enjoyments of sottishness or frivolity—not, in the language of weak and wretched men, to kill time, but to enjoy it as it is, as dear and precious, and to make the cultivation of your minds the sweet oblivion of your daily care. You associate for a purpose worthy of man that was made the image of his Maker. [*Great Applause.*] Gentlemen, I feel that I may hasten to conclude my combat with the arguments of those who are the enemies of popular knowledge, for I find that their arguments fight most lustily against one another. At one time they tell us that knowledge will cease to be valuable, because it will be cheap and common, and, therefore, will cease to be a distinction. At another time, that this dog-cheap knowledge will render the people proud and insolent, and unwilling to work. Knowledge ceases to be valuable when it ceases to be a distinction! Why, what if our common people, if all but the rich had nothing but gritty bread to eat, and foul water to drink, and if it were suddenly brought about that palatable bread and water, pure as the diamond spark, could be brought to our doors, what should we say to that man's sanity who should exclaim, this is no blessing; for it will now be no distinction to have wholesome bread and water? Is knowledge not intrinsically valuable? Is it a mere gaud and trinket to be worn for ornament? Is it not the staff of the human spirit? And as to knowledge making all men proud and discontented, let us be told which of the occult sciences it is that will work this marvellous effect in stultifying the human intellect and volition. For assuredly all the knowledge that is commonly known, has a tendency to make men sober and reflective. No: if every man, down to the paviours in the street, were as learned as Vossius and Scaliger, still, while human beings require food and raiment, they must work; and to suppose the contrary is to entertain the wildest chimera that ever entered the human brain. The enemies of popular knowledge tax the promoters of it with being visionaries; but I tax them, its enemies, with being the strangest visionaries on earth. Already the comparatively enslaved continent has become ashamed of such prejudices. When I had lately occasion to visit Prussia, and witnessed the noble institutions for making learning accessible to the meanest of his subjects, which Frederick William III. has endowed, I felt, for the first time in my life, my breast pay a tribute which a freeman's breast very seldom pays to an absolute prince in his own dominions; I felt a sensation of envy for royal power. Let me deprecate, in praising a foreign monarch for founding universities, the most distant intention of doing so at the implied expense of an august personage, against whom, if I were to touch the most oblique, latent, and invidious meaning, I should aggravate the meanness of disloyalty by that of personal ingratitude. [*Great Applause.*] Besides, it would be absurd, as well as malignant, for that august personage has no more than the presidents of North America, the power of disposing of the national wealth in founding universities, though, to the extent of his means, he has been a liberal patron of arts and science, whilst the king of Prussia is the sole steward of all the money of his kingdom. But still, let me say, that the institutions which his Prussian majesty has founded for learning, have won him the gratitude of his own people, and deserve the admiration of the world. But, thanks to Providence, the people of England can found all institutions of this kind for themselves. Your metropolis, itself, is richer than the whole Prussian dominions; its dense population facilitates our taking counsel together; it cheapens apparatus and books and teachers; let us avail ourselves of these advantages. Combination, in the most virtuous sense of the word, is your watch-word; and, as numbers constitute power, let me hope that numbers will follow your good example. For my own part, I shall suffer no man to say in my hearing without contradiction, that this expression of the popular desire for information is a passing rage or fashion. No; it rises out of the natural sagacity of the English mind, ripened by time and circumstances; and I boldly augur, that the spirit of improvement now displayed will be followed up with that steadiness which the world, in its rivalship with us in arts and arms, has felt to be inherent in Englishmen. I greet your association as a proof of reason being predominant in the public spirit, and I have only to exhort that you will

> " ~~~~~~~~ On reason build resolve,
> That column of true dignity in man."

LETTERS AND QUERIES.

Gentlemen,—I have been a constant reader of your highly useful publication since its commencement; and I most thankfully acknowledge that I have derived great pleasure and instruction from its valuable columns. There is one admirable department of the work that must unquestionably prove of much practical benefit. I mean the queries and answers; and if you, or any of your able contributors, could spare as much time as give a satisfactory answer to the following queries in an early Number, it would be conferring a very particular favour on your sincere well-wisher,

Philo-Mechanicus.

Inverness, 12th Dec. 1825.

1st. Is it practicable, at no great additional expense, to construct an undershot water-wheel in such a way as to be raised or lowered, with its gearing, at pleasure, according to the height of the stream supplying the water that gives motion to the wheel, where the fall is very small; so as on the one hand to get the better of *back-water* in time of speed, and on the other to adapt it to the lowest state of the river in time of great drought?

2nd. What would be the expense of a steam engine, including the erection, &c. capable of raising water to a reservoir at the height of 100 feet above, and a distance of 900 yards from the engine, at the rate of 160 gallons per minute; and what quantity of coals per hour, or day, would it consume?

MISCELLANIES.

Propagating Fruit Trees by Grafting.—The best luting wherewith to cover the newly grafted scions is composed of equal quantities of train oil and rosin, prepared in the following manner:—First, melt the rosin in an earthen vessel, then pour in the oil; mix them well; to be applied, when cold, with a painter's brush. This composition is used in the north-west part of France (Bretagne) with general success. It has this advantage, that it never cracks, nor admits rain or wind to the grafts, which is the usual cause of their failing. It is more expeditiously put on than the common clay covering, and looks much neater; but what renders it more useful is, that the grafts covered with this composition seldom fail. Scions laid under earth, or steeped in water for a few days, grow better than those taken from the parent tree. Grafting cherry or pear trees should not be delayed later than the 17th of March.

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THE GLASGOW MECHANICS' MAGAZINE,

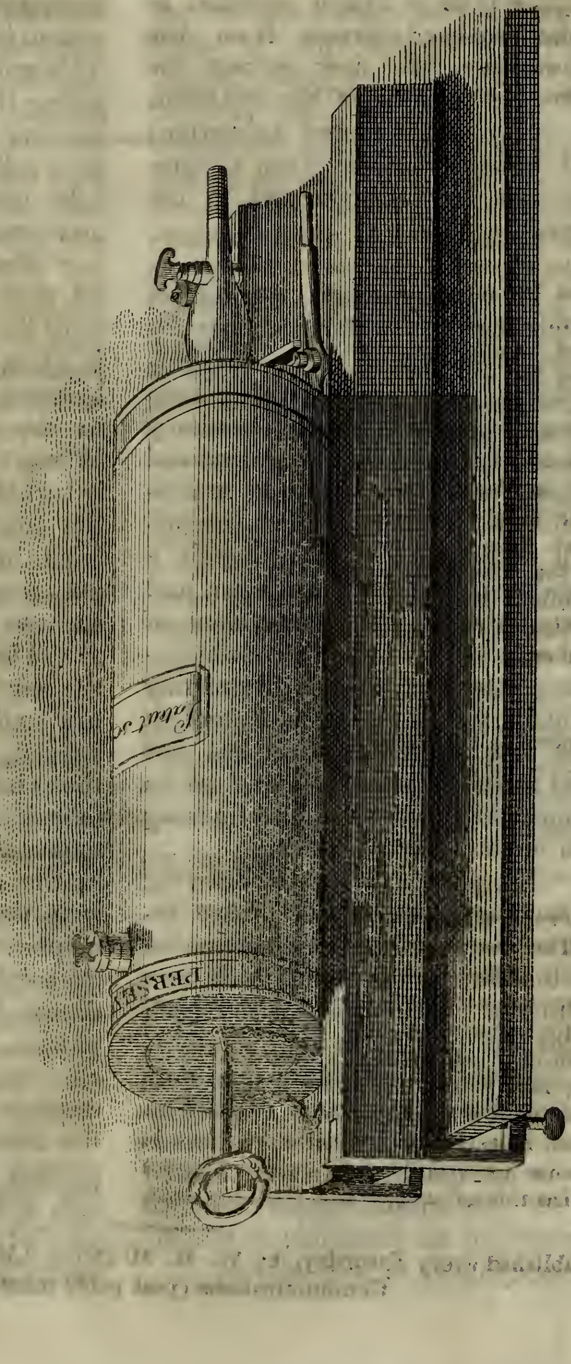
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

> ~~~~~~~~ "At intervals there gushed,
> Accompanied with a convulsive splash,
> A solitary shriek—the bubbling cry
> Of some strong swimmer in his agony!"

No. CX. *Saturday, 28th January,* 1826. Price 3*d.*

APPARATUS FOR RESTORING SUSPENDED ANIMATION.

By John Murray, F. S. A., F. L. S., &c.



APPARATUS FOR RESTORING SUSPENDED ANIMATION.

By John Murray, F. S. A., F. L. S., F. H. S., &c. &c.

In No. CV. we noticed a Pamphlet by Mr. Murray, of Paisley, giving an account of his shower bath, apparatus for restoring suspended animation, and invention for preserving lives in case of shipwreck. At that time we extracted a part of the description of the latter of these inventions; and we promised on a future occasion to make further extracts from the pamphlet. We now extract the following account of the apparatus for restoring suspended animation; and we have likewise given a representation of the apparatus in the plate.

" There is, perhaps, no subject which ought to excite a deeper interest, than that of *suspended animation.* The number of human beings who are hurried suddenly out of existence, by being deprived of that necessary pabulum, atmospheric air, forms annually a lamentable catalogue; and, although a Goodwyn, a Hawes, a Cogan, and many others of the benevolent of our species, have done much in exciting attention to this interesting subject, yet it is to be lamented, that the scientific world has not paid so much attention to it, as its importance most unquestionably and imperiously demands.

" The plate exhibits the drawing of an apparatus, which I have invented for restoring the lost action of the lungs. It consists of two cylinders concentric with each other; the inner one is *three inches in diameter;* the exterior one, *four inches,* forming a space of half an inch round the cylinder, which is to be occupied with water, heated to 98° (the animal temperature), to elevate the air contained in the interior cylinder to that degree.

" The piston is solid, and moves *horizontally;* the piston-rod is *perforated,* to receive a metallic pin, which, being introduced, shortens the stroke, checked by the plate covering the end of the cylinder, and gives the means of apportioning the volume of air to the *capacity* of the lungs, which is to be determined by the victim of experiment being of tender age, or adult. This will obviate the danger of injuring the lungs. To the pipe proceeding from this cylinder, is affixed a cell and cock, with an elastic tube terminating in a mouth-piece and plate of leather.

" The stop-cock is so constructed, that, when the handle is parallel with the pipe, as in the figure, there is a free communication established between the lungs and the cylinder, to the exclusion of external air. When, on the other hand, the cock is turned the quadrant of a circle, the communication with the lungs is cut off, and there is a free channel opened between the cylinder and the external atmospheric air.

" The lateral cell, appended to the cock, will be found of varied use and importance. Should the subject of experiment have been the victim of carbonic acid gas, (choak damp,) a drop or two of ammonia may be mingled with the air in the cylinder, and when thrown into the lungs will condense the mephitic gas. If a septic poison, (as sulphuretted or arsenicated hydrogen,) have occasioned the asphyxia, a few drops of solution of chlorine or nitro-muriatic acid will destroy the septic virus. Should the atmosphere be *too dry,* a small portion of hot water put into the cell, will mix with the air, and impart increased elasticity; and should an additional stimulus be required, a drop or two of ether deposited here, will expand in the air of the cylinder, and this mixed atmosphere will act with all the consequence of *nitrous oxide.* These provisions, for various reasons, are valuable auxiliaries in returning respiration.

"When this machine is to be used, the victim of suspended animation must be raised in a gently inclined position opposite to the operator; the nostrils are to be plugged up, and the plate of leather fixed on the mouth, as nearly air-tight, by means of white of egg, &c. as possible; this must be kept in its position by means of a ribbon tied round the head. The operator fronting the victim, manages uniformly and equally the piston. The apparatus being adjusted in the manner described, the air is first withdrawn from the lungs, and then ejected laterally; and the piston-rod being drawn to the extremity of the cylinder, (if an adult,) the pure atmospheric air fills the instrument; the communication with the lungs being restored by turning the stop-cock parallel with the pipe, the operator begins; about twenty plunges of the piston in a minute may be the proper number. It will not be necessary to change the included air, until *natural respiration* is restored; because, until this takes place, the blood cannot eject its excess of carbon, the consequence of the circulation of that fluid; but when it is required, it is instantly accomplished in the manner already described.

"This invention has met with the most unequivocal testimony of approbation from several eminent physicians and surgeons, and gentlemen of distinguished mechanical genius.

"I have presented the apparatus, with my last improvements, to the Royal Humane Society. It is made to rest in a groove, which may be easily fixed to a table by means of a clamp, and possesses an attached pin, which being fixed into the perforated piston-rod, readily apportions the injected air to the capacity of the lungs, whether of an adult or child. The flexible tube should be formed of cat-gut, coated with solution of Indian rubber, and be perfectly elastic and pliant like the bougie.

"In this improved apparatus, the heated water (which will be better at some degrees above 98° to compensate for the loss of temperature sustained by the conduction of the metal, and the transit of the air through the pipe into the receptacles of the lungs,) is supplied exterior to the inner cylinder, and above: thus affording every facility for ascertaining the temperature by a thermometer. There is also an exit-pipe, with a stop-cock to permit the water, when cooled, to flow off, so that without altering the position of the apparatus in the least, it may be supplied with heated water anew.

"The valve which communicates with the lungs, is Mr. Trevithick's conical one, used in the steam engine.

"The internal cylinder, being one foot long and three inches in diameter, will contain 84.82 cubic inches of air; about half this extent will be sufficient for any ordinary inspiration." *

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* "Dr. Hales estimates the number of respirations in a minute to be 20. Dr. Menzies breathed only 14 times in this period. Sir H. Davy estimates his respiration at about 26 times in a minute. Dr. Thomson states his at 19. *Twenty respirations* in *a minute* may be justly assumed as the average.

"Dr. Menzies estimates the quantity of air inhaled at each inspiration at 40 cubic inches. Allen and Pepys state it to be 16.5 cubic inches, in an ordinary inspiration, while the expiration is calculated, We further quote the following excellent remarks on the directions of the London Humane Society for the restoration of suspended animation.

"There are several items extremely injudicious in these directions, and even *noxious*. While the cautious administration of external heat is recommended, the body is to be gently rubbed with flannel *sprinkled with spirits!* as if it were not a matter of notoriety, that the evaporation of spirits from any surface, produces an *intense degree of cold.*

"The injection of tobacco smoke is not the least extraordinary of the recommended remedies. The direct action of this narcotic poison would be to paralyse the parts, instead of exciting them to action. This was indeed recommended by the celebrated Cullen, in his letter to Lord Cathcart, (see Letter, &c. Lon. 8vo. 1776. p. 14,) sanctioned, as I suppose, by *the authority* of the whimsical story of the soldier, &c. recorded at p. 45 of 'A Physical Dissertation on Drowning,' Lon. 1747, where many more absurd and idle tales of a similar complexion, may be found recorded. Dr. Paris characterizes injections of tobacco as 'one of the most stupendous errors that ever occurred in the exercise of the medical art.'* This, however, is only an echo of what has been before insisted on. Mr. Coleman, for example, p. 234, justly observes, 'we might with as much propriety recommend tobacco in syncope, or in a typhus fever, as in suspended respiration from drowning, &c.' † 'It is really,' continues Mr. Coleman, (p. 235,) 'an indelible stigma on the profession; that while we cannot but observe the deleterious tendency even of a small quantity of it, on one disease, (Hernia,) where we wish to reduce the strength; we nevertheless employ it by wholesale in another, where scarce a spark of life remains unextinguished. With heedless inattention we have persevered in its use, without ever asking ourselves this necessary question, What are we rationally to expect from such a remedy? This indeed is quackery in the highest degree.'

"This dangerous and destructive practice was first reprobated by Mr. Kite.‡ At p. 237, Mr. Cole-

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in a case of slow and full breathing, at 61 cubic inches. Dr. Bostock presumes that about 40 cubic inches is inhaled or expelled in the act of respiration. *Forty cubic inches* may be concluded on, as a near approximation to truth.

"Dr. Godwin infers that the mean quantity of air remaining in the lungs, after expiration, amounts to 109 cubic inches. Menzies states it to be, after an ordinary expiration, 179. In the same circumstances, Sir H. Davy estimates it at 118 cubic inches. Allen and Pepys found nearly 100 cubic inches of air in the lungs after death:—being an average of 126.5 cubic inches, in which Sir H. Davy's estimate is a near approach; and *one hundred and twenty cubic inches* may be considered the general average.

"From the experiments of Menzies, Crawford, Davy, Dalton, and Allen and Pepys, it seems to be clearly ascertained, that for the oxygen of the atmospheric air which has disappeared in the act of respiration, *an equal volume of carbonic acid gas* has been substituted, amounting, according to the experiments of Messrs. Allen and Pepys, to *about* 27.5 *cubic inches per minute.* Dr. Prout has deduced the mean or average at 3.45 per cent. of carbonic acid gas.

"Dr. Hales estimates the quantity of *aqueous water* emitted in respiration, at 20.4 ounces per day, and Dr. Thomson at nearly 19 ounces."

* "Medical Jurisprudence." Paris & Fonblanque. London. 1823. 3 vols.—See Vol. II. p. 88.

† A Dissertation on Suspended Animation. London. 8vo. 1791.

‡ See "Essays and Observations," &c. London. 8vo. 1795.

man describes the following conclusive experiment: 'A full grown cat was drowned, and the chest being immediately opened, the heart was observed to act strongly; six drachms of tobacco were thrown up the rectum in the form of smoke, but before the herb was half consumed, there remained scarcely any action in the heart; and after the whole had been ejected, all action ceased to be visible.' Mr. Kite had verified this fact by similar experiments.

"In No. 8, the warm bath is recommended 'when no signs of life appear.' Instead, therefore, of immersion into warm water being held important, it is evidently made a forlorn hope,—whereas it should hold a *primary* place in our estimation. The following observations from the 'Medical Jurisprudence,' are sufficiently apposite. 'The preservation of the body from the influence of external cold is always important, for it is only within a certain range of temperature that the vital functions can be performed. The body is incapable of producing heat. Where the heat is lost it should be gradually restored.'—'Under the head, Death from Cold, we have stated that the left cavities of the heart contain fluid blood; it therefore follows, that the directions of the Royal Humane Society are founded in error.'* There can be no question, that the difficulty of restoring the drowned proceeds from the sudden reduction of temperature, experienced by the system from the conducting powers of the medium.

"In my paper on the *heat* developed by the action of chlorine and nitrous acid gas, (published in the Philosophical Magazine,) I have shown that it must result from *a specific action on the skin;* and it would follow, could such a medium be applied judiciously to the exterior of the body, and yet the head be free from its influence, such an application might be of real service.

"Inflation by the *bellows,* it must be obvious to every one, is a rude and highly questionable operation. The inequality of the manipulation,—the unmeasured quantity of air thus propelled,—the unseemly and barbarous pressure on the chest, ribs, &c. all concur in its condemnation. 'The uncertainty,' says Mr. Coleman, 'of success, which has hitherto attended the cases reported by the Humane Society, has probably been, in a great measure, occasioned by the method that was adopted of conducting the artificial respiration.'* Respecting the bellows recommended by the Royal Humane Society, Dr. Paris observes, 'those manufactured for the service of the Royal Humane Society are not of a size sufficient to inflate the lungs of even a large dog, much less that of a man; nor is it necessary to employ a double bellows on this occasion, for the air will escape from the lungs without being drawn by suction; besides which, it is stated, that the forcible exhaustion of the lungs is liable to occasion pulmonic hemorrhage.'"†

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* P. 85. Vol. ii.

* P. 271.

† Vol. ii. p. 78.

ON THE FIGURE OF THE EARTH.

[From the Westminster Review.]

PHILOSOPHERS have long been agreed that the figure of the earth is a spheroid, differing very little from a sphere. The exact dimensions of this spheroid, or, in other words, the excess of the equatorial over the polar diameter, is a matter upon which they have not been so unanimous. Every new experiment—every improvement in the methods of mathematical analysis, has led to a new determination of the ellipticity. Newton, with the imperfect data of which he was then in possession, and assuming the earth to be a homogeneous mass, found, by a most subtle process, the ellipticity to be $\frac{1}{230}$ of the equatorial axis, or about 17 English miles. He was, of course, perfectly aware that the earth was not homogeneous, but that its density increased towards the centre. And here he committed one of the very few errors which are to be found in his writings. He supposed that the effect of an increased density toward the centre would produce a great flattening at the poles, and, consequently, that it would increase the ellipticity. The very reverse, however, is the effect of such an increase of density, as was first demonstrated by Clairault, in his Theorie de la Figure de la Terre, tirée des Principes Hydrostatiques.

The researches of Clairault, on this subject, were very curious. The most important point, however, for which we are indebted to him, is a very simple formula by which he connects the ellipticity with the centrifugal force at the equator; and which, as the latter can be deduced by means of the pendulum, enables us to find the former. This formula furnished the basis of Captain Sabine's determination of the ellipticity of the earth.

Repeated attempts were made during the eighteenth and the beginning of the nineteenth centuries to ascertain the excess of the equatorial over the polar axis, by means of measurements of portions of the meridian, or of parallels of latitude. The results obtained were so various as to induce a belief that the earth might approximate to a spheroid, yet that its surface was so irregular as to preclude the possibility of an exact determination of this question. Professor Playfair from a comparison of a portion of 3° 7′ of the meridian, measured in Peru, with another portion of 8° 20′, from Dunkirk to Perpignan, found the ellipticity to be $\frac{1}{300}$ nearly; and from another comparison of the same measurement in Peru, with another of 2° 50′, from Dunnose to Clifton, in Yorkshire, found it to be $\frac{1}{332.68}$; and infers that the true ellipticity in all probability lies between these two.

The Marquis de la Place, from a most profound analysis, gives $\frac{1}{306.57}$ "as the concurrent indication of the measurements of terrestrial degrees of pendulum experiments; and of the lunar inequalities dependent on the oblateness of the earth."

In all this, it is assumed that the figure of the earth is a spheroid. Newton, though he gave no demonstration of this proposition, soon found that its form could not be a sphere, and with that singular sagacity which seems almost to have sprung from inspiration, he assigned it a spheroidal figure.—MacLaurin, by a synthetical process of reasoning, which all succeeding geometers have concurred in regarding as one of the finest recorded specimens of mathematical investigation, first showed that a homogeneous fluid body, in the form of a spheroid will fulfil all the conditions of equilibrium arising from the attraction of the particles, and the centrifugal force of rotation. This question then naturally suggested itself: Is the spheroidal the only form that fulfils these conditions, or are there others? It was destined for Legendre to show directly that a spheroid is the only body which fulfills these conditions, and, consequently, that it is the only figure which, in the circumstances of our globe, could be in equilibrium. He demonstrated that, with the velocity of rotation which our earth has round its polar axis, there are two spheroids which fulfil the conditions of equilibrium. One of these is, of course, the form which it actually has, in which the ellipticity is very small, and its figure something like that of a turnip; in the other case the ellipticity is very large, the equatorial axis to the polar axis being about as 600 : 1, (if our memory serve us right,) and its form approximating to that of a mill-stone. The former of these is what mechanical philosophers call a *stable* equilibrium, the latter an *unstable* equilibrium; and in the latter case it is obvious that the centrifugal force would be so great, that if a body of such a form were placed in our system, subject to its disturbing force, its particles would instantly fly off into space. The Marquis de la Place resumed the same inquiry, generalized it, and gave a theory of the earth, distinguished by the depth and elegance which characterize all his investigations.

Mr. Ivory, in the Philosophical Transactions for 1824, has discussed the same question in a very elaborate and ingenious paper. He has extended the investigation to spheroids of any ellipticity whatever; Legendre and the Marquis de la Place, for the purpose of avoiding some difficulties of calculus, having confined themselves to the case of spheroids like the earth, of small eccentricity. He has generalized Legendre's proposition respecting the two spheroids of equilibrium, which had been obtained by a particular process, into a very beautiful proposition, which may be thus enunciated: "If a homogeneous mass of fluid, at rest, be acted upon by the force of attraction, it will be in equilibrium in the form of a sphere; if this sphere begin to revolve round an axis passing through its centre, it will become an oblate spheroid, and as the velocity increases, that oblateness will increase, till the equatorial axis is to the polar as 2.7197 : 1; beyond this proportion the velocity must diminish, to preserve the equilibrium, and the oblateness will go on increasing—the fluid approximating to a circular sheet as the velocity decreases to zero."

We see, from this, that there will be no velocity of rotation, either when the oblateness is zero or infinite.

Captain Sabine's object,* it has been already mentioned, was to apply the theorem of Clairault on the earth's ellipticity by means of pendulum observations. The thing to be obtained by him was the total diminution of the force of gravity from the pole to the equator. As the intensity of the force of gravity in any latitude is directly obtained from the time in which a given pendulum oscillates, and as the law of its diminution, assuming the earth to be a spheroid, is very simple, a single observation of the pendulum, in a given latitude, would enable us to compute the total diminution of the force from the pole to the equator; this would, of course, furnish only an approximation to the true value; to obtain one more exact, we must have a considerable number of these observations, and spread over as great an extent of the meridian as possible. This was the plan adopted by Captain Sabine. By observations the most delicate and very numerous, he determined the length of the seconds pendulum at thirteen different stations, the most remote of which are Bahia, in 13° of south, and Spitzbergen, in 80° of north latitude. He combines these by the methods of *the least squares*, and deduces 39.01568 for the length of the equatorial pendulum, and 0.20213 for the total diminution of the force of gravity from the pole to the equator. From hence, by Clairault's formula, he obtains the value of the ellipticity to be $\frac{1}{288.4}$ of the equatorial diameter.

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* An Account of the Experiments to determine the Figure of the Earth. By Capt. Sabine, R. N. London. 1825.

This is his own independent result, which, intrinsically, without reference to any corroborating circumstances, possesses considerable claim to credit—a credit which is very materially strengthened by some important considerations, which we shall just advert to. Combining his own observations, with the length of the pendulum, as determined by Captain Kater at the seven principal stations in the trigonometrical survey of Great Britain, he obtains $\frac{1}{289.5}$ for the ellipticity; and from a similar combination with the length of the pendulum, as determined by Messrs. Arago, Biot, &c. at eight different stations, between Unst and Formentera, he finds $\frac{1}{288.5}$ for the ellipticity, and finally combining the whole together, he finds it to be $\frac{1}{289.1}$. The very near agreement of the two former of these results with that of Captain Sabine may undoubtedly be considered a strong confirmation of that which he had himself deduced from observations more exact, more numerous, and separated by greater intervals of the earth's surface, than were ever before brought to apply to this problem.

There are two objections which immediately suggest themselves to the accuracy of this value; the first is, that all his stations are on small islands of the Atlantic ocean, or at places immediately situated on the Atlantic board. A series of observations, similarly conducted, in the interior of the American or Asiatic continents might very possibly lead to results widely different from that which is now found. The other objection arises from the principle of the method. If Clairault's theorem, which furnishes the basis of this method, were a necessary truth, the method would be perfect; but Clairault's theorem is merely an approximate theoretic formula, assuming certain data, (which may or may not be false,) and, therefore, we conceive it to be a very unstable foundation to build upon.

When Captain Sabine, after having gone through the computations we have been describing, says, "it is not easy to anticipate what accumulation, or what variety of experimental evidence will be required in a final determination of such magnitude as that of the exterior configuration of the earth," it is not difficult to perceive that in his own mind there is a lurking feeling that he has himself already accomplished this object. For ourselves, we regard this result as a good approximation—nothing more; we have no hesitation in thinking it as good as any other. But it produces no irresistible conviction in our minds: we look, indeed, upon the whole question as one of those which will never be accurately resolved, and have long been in the habit of classing it among those barriers which are to limit the progress of human inquiry. The determination of the earth's ellipticity, and the quadrature of the circle, we deem to be no unfit associates; they have exercised the greatest minds in researches unprofitable and useless, as far as the immediate object was concerned, although, collaterly and indirectly, the pursuit has led them to some of the most brilliant discoveries which grace the annals of physical philosophy.

DUNFERMLINE MECHANICS' INSTITUTION.

The managers of this Institution, which continues to prosper as well as the most sanguine wishes could desire, have engaged the Rev. Mr. Fergus, of the Relief Congregation there, to deliver a course of twelve lectures on Natural Philosophy and Chemistry. These lectures are to be delivered once a week until they are finished. The night of meeting is every Wednesday, at a quarter past eight o'clock. The ticket for the whole course is three shillings; and for each lecture, one shilling. The lectures have been attended by an audience of nearly 500 mechanics.

We would suggest to the managers of this Institution, the managers of the Stirling Mechanics' Intitution, and of the new Institusion forming at Alloa, the expediency of procuring a lecturer at their joint expenses, who would lecture at their several institutions in rotation. A plan of this kind would make it worth the acceptance of a lecturer, and would have all the advantages of their having each a separate one. It could be little additional trouble to the lecturer, as these towns are in the neighbourhood of each other.

AYR MECHANICS' INSTITUTION.

To industry, do we ascribe that eminence to which Scotland has been exalted. Her peasantry are a laborious, plodding sort of people, free from those indolent habits which never fail to bring about penury, ruin, and wretchedness. Every hamlet seems now emulous to proceed in the paths of knowledge, and inquire into those sciences, whereby the mind of man is ennobled and enriched: and certainly this is a state of things which must have a prodigious effect on the moral and religious improvement of the people. In Ayrshire a great number of philosophical societies have been set on foot, and scarcely is there a village for many miles around us, that has not its philosophical, literary, or debating society. In Ayr, we rejoice at the growing prosperity of our Mechanics' Institution. A class has been formed, having upwards of 120 members, and a library is about to be opened for their use. To the unwearied exertions of Mr. James Ritchie, are our mechanics indebted—and we assure them they will never repent that such an able and successful teacher has been engaged. In fact, it is the very soul of the Institution, that Mr. Steele has been engaged to lecture for the first year: he has implanted a spirit, where none appeared to exist —he has called forth many a *latent* energy, and imparted instruction enough to arouse the most indolent and lukewarm. We admire his communicative disposition, and we do this the more when we consider that there are certain persons in

Ayr, connected with public works, who will not allow that the gate of knowledge should be thrown open to all. We press home on such persons the words of Mr. Steele, for their consideration, "I have no secrets worth keeping, you are all welcome to examine my apparatus, and any information I can give, is at your demand." This is the declaration of every liberal and generous mind. In our next, we will give a few remarks on the various Institutions in Ayr.—*Ayrshire Magnet.*

ON TWO KINDS OF TREES PECULIAR TO NEW ZEALAND.

New Zealand, it is well known, produces some of the finest timber trees in the world; two of them are pre-eminently distinguished for their amazing size, and the excellent qualities of their timber. The first of these is the Cowrie of the natives, which grows to the height of 140 to 180, and frequently even to 200 feet, with a trunk clear of branches for 80 or 100 feet, perfectly straight, and with a diameter of 5 to 9 feet. The quality of the timber is equal to the best Riga fir, and is admirably adapted for ship-masts. This tree is a congener of the Amboyna Pitch-tree, the *Pinus Dammara* of the first volume of Mr. Lambert's work; but which, in the second volume of the same, has been justly constructed into a new genus, under the name of *Dammara;* the Amboyna species being there denominated *Dammara orientalis*, and the Cowrie, or New Zealand species, *Dammara australis*, of which a magnificent plate has been given by Mr. Lambert. The tree yields, both by incision and spontaneously, a pure and limpid resin, which soon hardens on exposure to the air. This resin has been found on trial to equal the best copal varnish. The Cowrie delights in dry elevated situations, and forms the most striking object of a New Zealand forest, where it is seen towering above the surrounding trees. The only plant of this interesting tree in Europe, is in the fine collection of the Horticultural Society of London, at Chiswick, where it is kept in the greenhouse, and is very luxuriant. The second is the *Kakaterre*, the *Dacrydium taxifolium* of Solander; but which, however, must form a separate genus. This tree equals the former in size, but the quality of its timber is inferior. It delights in low marshy ground, and in foliage resembles the yew.

TABLE FOR THE CONSTRUCTION OF SUN-DIALS.—By Mr. M. Smith.—From the Philosophical Magazine.

All the tables for the construction of sun-dials which I have hitherto seen, are extremely erroneous, being calculated on the supposition that the shadow is cast from the centre of the sun; and, therefore, any dial constructed from such tables must invariably err one minute of time from the truth. The following table is computed on the principle that the shadow is cast from a point in the sun's disk, one minute of a degree within that limb which is nearest to the meridian, and, consequently, 15 minutes from the sun's centre. The shadow, therefore, coincides with the meridian at one minute of time from noon. This remark must be particularly attended to, as it follows that the hour angle for noon is negative; consequently the upper line in the table, or that standing opposite to 0h. 0m. is to be set off from the meridian in the contrary direction from all the others, which will have the effect of contracting the double hour-line for twelve o'clock, so as to render it somewhat less in thickness than the gnomon, or style of the dial.

The Angles which the Hour-lines make with the Meridian in a Horizontal Dial, for each Degree of Latitude in England.

Hour from Noon.		Latitude.													
		50°		51°		52°		53°		54°		55°		56°	
H.	M.	°	'	°	'	°	'	°	'	°	'	°	'	°	'
0	0	0	12	0	12	0	12	0	12	0	12	0	12	0	12
	15	2	41	2	43	2	46	2	48	2	50	2	52	2	54
	30	5	34	5	39	5	43	5	48	5	52	5	57	6	1
	45	8	29	8	36	8	42	8	49	8	56	9	3	9	9
1	0	11	24	11	34	11	43	11	52	12	1	12	10	12	19
	15	14	22	14	34	14	46	14	58	15	9	15	20	15	30
	30	17	24	17	38	17	52	18	6	18	19	18	32	18	44
	45	20	30	20	46	21	2	21	17	21	32	21	47	22	1
2	0	23	39	23	57	24	15	24	32	24	49	25	5	25	21
	15	26	53	27	13	27	33	27	52	28	11	28	28	28	45
	30	30	13	30	35	30	56	31	16	31	36	31	55	32	14
	45	33	40	34	3	34	25	34	46	35	7	35	27	35	47
3	0	37	13	37	37	38	0	38	22	38	44	39	5	39	25
	15	40	53	41	18	41	42	42	4	42	26	42	47	43	8
	30	44	42	45	6	45	30	45	53	46	15	46	36	46	57
	45	48	38	49	3	49	27	49	49	50	10	50	31	50	52
4	0	52	43	53	7	53	30	53	52	54	13	54	33	54	53
	15	56	56	57	19	57	41	58	1	58	21	58	40	58	59
	30	61	18	61	39	61	59	62	18	62	6	62	53	63	10
	45	65	48	66	6	66	24	66	41	66	57	67	12	67	27
5	0	70	25	70	40	70	55	71	9	71	23	71	35	71	48
	15	75	8	75	20	75	32	75	43	75	53	76	3	76	13
	30	79	56	80	4	80	12	80	20	80	27	80	34	80	41
	45	84	47	84	52	84	56	85	0	85	4	85	8	85	11
6	0	89	41	89	41	89	41	89	41	89	41	89	42	89	42
	15	94	34	94	30	94	26	94	23	94	19	94	16	94	13
	30	99	26	99	18	99	10	99	3	98	56	98	49	98	43
	45	104	14	104	2	103	51	103	41	103	31	103	21	103	12
7	0	108	58	108	43	108	28	108	15	108	2	107	49	107	37
	15	113	36	113	18	113	1	112	44	112	29	112	14	111	59
	30	118	6	117	46	117	26	117	8	116	50	116	33	116	16
	45	122	29	122	7	121	46	121	25	121	5	120	46	120	28
8	0	126	44	126	20	125	57	125	35	125	14	124	54	124	35
	15	130	50	130	25	130	1	129	39	129	17	128	56	128	36
	30					133	58	133	36	133	14	132	53	132	32
	45											136	42	136	21

ESSAYS ON BLEACHING,

By JAMES RENNIE, A. M. Lecturer on Philosophy, &c. &c., London.

No. III.—CHEMICAL AGENTS USED IN BLEACHING.

SECTION VII—*continued.*

5.—*Tests for ascertaining strength of Oxymuriate of Lime.*

IN treating of the other agents of bleaching, we have seen of how much importance it is to the manufacturer to be able to ascertain the quantity of efficient matter in any of the substances of commerce which he has occasion to purchase. With respect to oxymuriate of lime, this ought, perhaps, to be still more attended to, in so much as it is the principal agent for producing pure whites. But I am much mistaken if any method has come into general use among bleachers, by which the quality of a given quantity of this substance can be ascertained.—They are under the necessity, indeed, of ascertaining the bleaching power of the diluted liquid, previous to immersing their goods, which is commonly done by an indigo test, and in this way, by observing the quantity of salt and the proportions of water used, they may make a rude guess concerning the strength of the salt when purchased; but this at best must be an inaccurate method of proceeding. To remedy those inconveniences, the ingenious Mr. Dalton instituted a course of experiments, in which he was successful in obtaining a test of easy application for ascertaining the purity of oxymuriate of lime.

From these experiments it appears, that the green sulphate of iron is by far the best test of oxymuriate of lime. As the indigo test does very well in ascertaining the strength of the diluted liquor, and as it is very generally used, I cannot well omit detailing the manner of its application. Prepare a very dilute solution of indigo by dissolving, in the usual way, a pound of the best Spanish in four pounds of concentrated sulphuric acid, which proportions will generally be sufficient to produce saturation. When all the indigo is dissolved, one part, by measure, of this solution is to be diluted with sixteen parts, by measure, of water, when it will be fit for use. To obviate any deception which may arise from the difference of strength in the indigo, it is best always to preserve some of a former preparation to compare with the new, when, by a little management, it may be made equal. The quantity of water used is not material, provided that the same bleacher keep always to the same proportion. The strength of the bleaching liquor is determined by the quantity of it which is required to destroy the colour of any given portion of the test. In practice it is usual to have two graduated glass tubes, one for the test, the other for the liquor, by which arrangement the efficient quantities are seen by inspection. Berthollet says he was informed by Mr. Watt, that the indigo test will not accurately show the strength of either oxymuriate of soda or of potash, and recommends a decoction of cochineal, as not being so liable to inaccuracy or deception. From what I can learn, however, this has not been found so convenient in practice as the indigo test. Mr. Dalton's test from sulphate of iron, will soon, I imagine, supersede all others.

IRON STEAM BOAT.

A BOAT of sheet iron, intended for a passage-boat, from Colombia, on the Susquehanna, to Northumberland, is constructing at York, in this State. The following is an account of the boat, and of the steam engine by which it is to be propelled:—

The boat has 60 feet keel, 9 feet beam, and is 3 feet high; she is composed entirely of sheet iron, riveted with iron rivets; and the ribs, which are one foot apart, are strips of sheet iron, which, by their peculiar form, are supposed to possess thrice the strength of the same weight of iron in the square or flat form.

The whole weight of iron in the boat, when she shall be finished, will be 3400 lb.; that of the wood work, decks, cabin, &c. will be 2600 lb.; being together three tons. The steam engine, the boiler included, will weigh two tons; making the whole weight of the boat and engine but five tons.

She will draw, when launched, but five inches, and every additional ton which may be put on board of her will sink her one inch in the water.

The engine is upon the high pressure principle, calculated to bear 600 lb. to the inch, and the engine will be worked with not more than 100 lb. to the inch. It will have an eight-horse power, and the boiler is formed so that the anthricite coal will be used to produce steam. The ingenuity with which the boiler is constructed, and its entire competency for burning the Susquehanna coal, are entitled to particular notice; and the inventors, if they succeed in this experiment, will be entitled to the thanks of every Pennsylvanian.

The boiler is so constructed as that every part of the receptacle for the fire is surrounded by the water intended to be converted into steam: and thus the iron is preserved from injury by the excessive heat produced by the combustion of the coal. Its form is cylindrical; its length about six feet, and it will be placed upright in the boat, occupying, with the whole engine, not more than ten feet by six feet.

The engine is nearly completed. The whole cost of the boat and engine will be 3000 dollars.

REPLY

To Mr. David Campbell's Statement of Claims to the Invention of the Process for Discharging Turkey Red.—Inserted in the Glasgow Mechanics' Magazine, No. LXXXIX, Sept. 3*d*, 1825.

GENTLEMEN,—With a view no doubt to bias the public mind, Mr. Campbell asserts that I have made an attack on his credit and character by erroneous insinuations. This I deny. I make no insinuation, but state undeniable facts. Mr. C. says my first attempts to discharge were posterior to the invention and extensive practice at Blantyre; and long before the appearance of Tennant and Knox's salt. That the salt in question, and the application of it to Turkey-Red discharging, was unknown to Mr. Campbell, is readily granted; but to me it was no secret: and what will Mr. C. say when I inform him that Mr. Tennant obtained his patent for making the said salt in the year 1798? Was this posterior to his great business at Blantyre? which, according to his own account, commenced some years after. But he discharged with Berthollet's liquor, and with plane surfaces; whereas I did, and every one now in the business, discharges with Tennant's salt and with bandages. No wonder, then, he could not succeed!

Now, Gentlemen, what I contend for,

and claim as my own invention, is the introduction of Tennant's salt to discharge, a bandage to preserve the accurate shape of the figure required, and the construction of the cast metal presses presently in use. These, in justice, cannot be denied me; and let Mr. Campbell, or whoever will, take all the rest, with all the improvements that have since been made. I advance, without the fear of contradiction, that without Tennant's salt and bandages, the discharging of Turkey-Red never would have been a business. I mounted my first models with lead, as well as brass bandages, well knowing that two plane surfaces, although made of gold or platina, never could produce a neat and distinct figure. In my first large press, brass tubes, or types, projecting from the surface, formed the bandages; whereas the present mode consists in forming the bandages on the surface, and then chiselling or clearing away the intermediate spaces, leaving the bandages behind—but still there are bandages the same in principle as my original models. Mr. Campbell says he does not know what a bandage is. This is allowable in him; but when he says no mechanic knows such a thing as applied to Turkey-Red discharging, surely this is too much. There is not a print-cutter in the whole trade but would give the most unqualified negative to the assertion. That Mr. C. did order a press from Mr. Roberton, on the principle of mine, is true; true it is, also, that Mr. C. neither understood nor could work it; that the Company gave Mr. Roberton a sum of money to take it back; and that the same press was sold afterwards to Messrs. Thomson and Frazer, Parkholm, from which they produced good work. Why Mr. C. produces the Company's letter, to prove the return of the press, I presume not to determine; but he adds, triumphantly, this is a very humiliating letter, and needs no comment. Humiliating, indeed; and the less Mr. C. comments on it the better. Could any thing short of stupidity bring this letter into notice, which must so forcibly revert the intended blow against himself?

But this is not all. Bent upon another trial at discharging, Mr. C. put the Company to the expense of another press, with some supposed improvements of his own. All, however, would not do. The uncouth protuberance of the brass bandages bewildered him. By a few trials, the press was broken; and Mr. C. remained in the back ground. I formerly stated, that in consequence of Mr. C.'s bungling method of discharging at Blantyre, that business was given up; Mr. Rodger was sent to the warehouse in Glasgow; M'Callum was put to the warping; and Messrs. M'Brayne, Stenhouse, & Co. discharged for the Blantyre Company. This I repeat.—The following letter, from John Primrose, will evince that Mr. Rodger left Blantyre previous to 1808, as stated by Mr. Campbell:—

"Glasgow, 10th Nov. 1825.

"Sir,—I have read Mr. D. Campbell's statement of claims to the Turkey-Red discharging. Whatever merit he may attribute to himself, I presume not to observe on; but that he does not know what a bandage is, is somewhat strange, as there can be no proper discharging without one. As to Mr. G. Rodger not leaving Blantyre Works until the year 1808, I can say, that some years prior to that date, Mr. R. and I both dwelt in one land, in the Boarhead Entry, opposite the Barracks—after which he moved to Barrowfield Road, during which time Mr. Rodger was employed in Messrs. Bogle, Monteith & Co.'s, Glasgow.

"John Primrose.

"Mr. John Miller, Hill-Street, Glasgow."

I also present you, Gentlemen, for your private satisfaction, the attestation of four men that wrought in the same flat with M'Callum when he was at the warping; but, from particular circumstances, I decline giving publicity to their names.* It is an indisputable fact, that Crossmill Company discharged for Blantyre Company, from 1805 until 1809. My first large press was made and mounted in 1804; Crossmill Company began in 1805; Messrs. Andrew Campbell & Co. in 1805; Neilson and Baird, in 1805; Robert Thomson and Son, in 1805–6; Thomson and Frazer, in 1807; Dalmarnock Company, in 1808; and Messrs. Henry Monteith & Co. Barrowfield, in 1809. Then, and not till then, under the superintendency of Mr. George Rodger, did that Company succeed; and, as they augmented their number of presses, they gradually withdrew their discharging business from Crossmill Company, which closed in 1811. From these facts, it is evident Mr. Campbell has no more claim to the invention of Turkey-Red discharging than I have to Power-Loom Weaving or Steam Navigation. I must not omit taking notice of my sheer blunder, as Mr. C. is pleased to term it, in that I said Mr. C. could not have been lawfully discharging without an entry with the Excise, a license, and the measurement of every piece. This Mr. C. treats with the utmost contempt, by asserting that the Excise Laws were at that time in force only as to the printing, and not as to the discharging. Whether Mr. C. has made a sheer blunder, or if he knowingly meant to state what was not true to those who were unacquainted with the Excise Laws, let him say; but it is not to be disputed, that his assertion as to this is false, for there has been no alteration in that respect since the reign of Queen Anne. This every person connected with the Excise knows; and that bandannas came as much under the Excise Laws, from the general terms in which they are expressed as any other species of printing. This is proved by Mr. M'Farlane's letter, which I have sent you, and might by a hundred others. The plain truth is, that in 1804, Messrs. Monteith, Bogle, & Co. more honourable than to defraud the Revenue, consulted the proper authorities, and sent two specimens, or trials, through the medium of the Collector of Excise, to the Commissioners in Edinburgh, for their opinion, whether such goods were subject to the existing duties, as the spots which made the two colours were not "printed, stained, painted, nor dyed," the express words of the law. Their answer was, "The goods being of two colours, by whatever means it was effected, rendered them liable to the duty;" and, in consequence of this opinion, the Company were put under the Excise. As to his great business of ten presses, the amount of the duties paid to the Excise must have been in proportion, and of course very considerable. I now demand of Mr. C. an Excise extract of the duties paid by Blantyre Company previous to 1809, which will at once show the extent of his boasted business. This can be easily done; and, until it is produced, I must infer that it cannot, or is not worth producing. Where, now, is my erroneous insinuations? Did Mr. Rodger not leave Blantyre till 1808? Where is my sheer blunder? When was the alteration of the Excise Laws? And why, and when, did Mr. C. give up his extensive business, his ten presses, with infinitely fine and varied engravings of gimlet and drilled holes?

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* This letter is in our possession.—Eds.

Allow me now, Gentlemen, to make a few observations respecting my former evidence, which Mr. C. would wish to set aside by the pitiful appellation of humble mechanics, one excepted, who, as being a little lower in the order of morality, is styled a mere labourer. It happens, however, that this mere labourer is both an artist and a mechanic, and for upwards of forty years past has been engraver and copperplate-printer to a Company who always ranked in the first class for elegance of taste and neatness of execution. Surprising, indeed, a labourer could have done so; and I can in no way account for Mr. C.'s contumely to J. M. otherwise than as being envious of his merit. J. M., by my directions, mounted my presses at Crossmill, superintended their operations, and produced superior work, which work went to Blantyre Company, and far surpassed even the genius of Mr. C. in his most refined system of amalgamated tin and plane surfaces.

As to the other part of the former evidence, they are all mechanics in the strictest sense of the word, following a profession which royalty does not feel ashamed to countenance and to applaud; and to which every enlightened mind must pay its tribute of respect and approbation. As to the brass bandages injuring the cloth and ruining Companies, this is a mere subterfuge for bungling. It is beyond a doubt, that the damages was not the result of brass bandages, but from ignorance in preparing the liquor, and in the process subsequent to discharging.

I am, Gentlemen, yours, &c.
John Miller.

Glasgow, 18th Dec. 1825.

THE ANT AND THE BEE.

These interesting insects resemble each other very much in their habits, considered separately as well as a community; and the observation of the method in which their little societies are managed, the regularity, harmony, and economy conspicuous throughout, to a properly disposed mind, affords both pleasure and instruction.

Goldsmith, speaking of the ant, says, "Though the number of two winged flies be very great, and the naturalists have taken some pains to describe their characters and varieties, yet there is such a similitude in their forms and manners, that, in a work like this, one description must serve for all. We now, therefore, come to a species of four winged insects that are famous from all antiquity, for their social and industrious habits, that are marked for their spirit of subordination, that are offered as a pattern of parsimony to the profuse, and of unremitting diligence to the sluggard." This is said of the ant, but the sentence is equally worthy of the bee. "There are three different kinds of bees in every hive," says M. De Buffon, keeping his eye upon "Reaumur's delightful researches," as he terms them: "first, the labouring bees, which make up the far greatest number, and are thought to be neither male nor female, but merely born for the purposes of labour, and continuing the breed, by supplying the young with provision while yet in their helpless state. The second sort are the drones, they are of a darker colour, longer, and more thick, by one-third, than the former; they are supposed to be the males; and there is not above a hundred of them in a hive of seven or eight thousand bees. The third sort is much larger than either of the former, and still fewer in number, some assert that there is not above one in every swarm, but this, later observers affirm not to be true, there being sometimes five or six in the same hive: these are called queen bees, and are said to lay all the eggs from which the whole swarm is hatched in a season." "Like bees," says Goldsmith, speaking of the ants, "they are divided into males, females, and the neutral or the working tribe; these are all easily distinguished from each other; the females are much larger than the males; the working ants are the smallest of all: the two former have wings, which, however, they sometimes are divested of; the latter never have any, and upon them are devolved all the labours that tend to the welfare of the community; the female, also, may be distinguished by the colour and structure of her breast, which is a little more brown than that of the common ant, and a little bigger than that of the male." From these quotations a great resemblance is apparent between these insects; there are three classes of each, and each class bears a resemblance to the same class of the different insect; the neutral, or working bee, and ant; the male bee and ant; the female bee and ant. The first class of each kind is the smallest in its kind; the second class is larger; and the third class, or females, of each kind is the largest.

"In the fields of England, ant-hills are formed, but with little apparent regularity. In the more southern provinces of Europe, they are constructed with wonderful contrivance, and offer a sight highly worthy a naturalist's curiosity. These are generally formed in the neighbourhood of some large tree, and a stream of water; the one is considered by the animals as the proper place for getting food, the other for supplying them with moisture, which they cannot well dispense with; the shape of the ant-hill is that of a sugar loaf, about three feet high, composed of various substances, leaves, bits of wood, sand, earth, bits of gum, and grains of corn; these are all united into a compact body, perforated with galleries down to the bottom, and winding ways within the body of the structure." The bees, though they do not build any citadel, properly speaking, like the ant, having once provided themselves with a proper hive, proceed to work in a somewhat similar manner. They have one division of their little state—in like manner as the ants have theirs—which forages abroad in quest of food and provision, both for present subsistence and to store up against inclement seasons, another division to receive and carefully to lay past the produce of the day's search, besides those that are employed in forming the cells, and properly laying out the work. Every member is vigilant and active, and all is conducted with the most admirable harmony.

(To be continued.)

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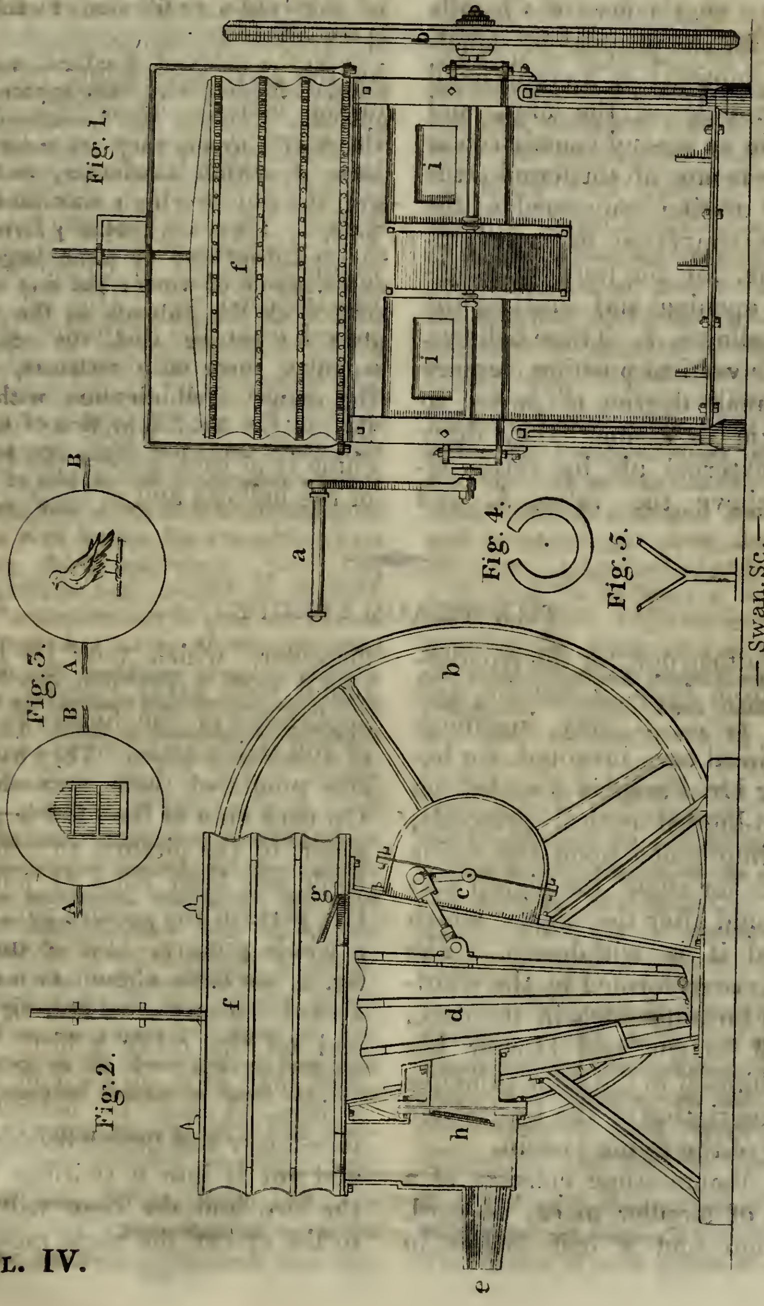
A Committee of Civil Engineers and Practical Mechanics.

> "Then towns he quicken'd by mechanic arts,
> And bade the fervent city glow with toil;
> Bade social commerce raise renowned marts,
> Join land to land, and marry soil to soil,
> Unite the Poles, and without bloody spoil
> Bring home of either Ind the gorgeous stores."

No. CXI. *Saturday, 4th February,* 1826. Price 3*d.*

IMPROVED BLOWING MACHINE; THAUMATROPE, &c.



IMPROVED BLOWING MACHINE.

By Messrs. JEFFRIES & HALLEY, Great Guildford, Southwark.

FIG. 1 is an end view of the machine; and fig. 2 is a section of it, taken in the opposite direction.—The same letters in the following description refer to the same parts in both figures. *a*, a cranked handle, worked by two or more men, or by any other power, according to the size of the machine; *b*, a fly-wheel fixed on the end of the axis, opposite to that where the handle is placed, for the purpose of equalizing the motion; *c*, a crank fixed on the middle of the axis, and working in an air-tight semicircular box. By means of this crank, the revolving motion impressed at the handle, is converted to a reciprocating one, for the purpose of alternately opening and shutting the vertical bellows, *d*. These bellows, from their vertical position, require only a small degree of power to keep them in action; they draw in the external air by valves situated above the valve, *h*, and discharge it through the valve, *h*, into the nozzle, *e*.

The box, or outer case, in which the vertical bellows are inclosed, being air-tight, it necessarily follows, that when, by the action of the crank, *c*, the bellows are compressed, a partial vacuum will be formed in the box. In order to restore the equilibrium, a portion of external air will rush in through the valves, *i*, *i*, which portion will, by the next succeeding expansion of the bellows, be driven through the valve, *g*, into the head or regulator, *f*, which it inflates and raises, and the top of which may be loaded with weights, in order to give any requisite degree of compression to the inclosed air. This air is expelled from the regulator through a valve opening downwards, into the trunk of which the nozzle, *e*, is the exit. The whole of the machine is of iron, except the leathers of the bellows and of the regulator.

THE THAUMATROPE.

THE Thaumatrope, (or the wonder-turner, from θαυμα, *a wonder*, and τϱεπο, *to turn*,) a very ingenious philosophical toy, invented, we believe, by Dr. Paris, is founded on the well-known optical principle, that an impression upon the retina continues for about the eighth part of a second after the object which produced it is withdrawn. The luminous rings formed by the whirling of a burning stick in the dark, are well known, and Homer has availed himself of the same principle in his description of the lengthened shadow of the flying javelin.

The thaumatrope consists of a number of circular pieces of card, about four and a half inches in diameter, which may be twisted round with great velocity by the application of the fingers to pieces of silk string attached to two opposite points of their circumference. On each side of the card is painted a part of the picture, so that if we could see both sides at once, the two parts of the picture would form a whole picture. For example, in fig. 3, we have shown two sides of a card, on one of which is a cage, and on the other a bird. If we now take hold of each of the silk strings, A and B, between the fore-finger and thumb of each hand, and put it into a twirling motion, the bird and the cage will appear to the eye at the same moment, in consequence of the impression of each continuing in the retina for a short space of time.

Those who have used the thaumatrope, must have been dissatisfied with the general effect of the two combined pictures. There is a hobbling motion arising from the imperfection of the method adopted to produce the rotatory motion, which entirely destroys the effect; and it is manifest that the rotatory motion should be produced by quite different means.

If strings are adopted, they ought to be attached to the circular pieces of card, so that the axis of rotation should be in the plane of the card; but a solid axis of rotation is decidedly preferable, and will produce much more pleasing combinations.

INDIAN MODE OF CONSTRUCTING CANOES.

Gentlemen,—I send you a description of the method used by some Indians in the construction of their canoes. The great size of these may have surprised some of your readers, and excited a wish to discover where timber of sufficient magnitude could be procured. The following is an explanation which was given me by a gentleman who has seen them made, and whose turn of mind led him to investigate these subjects. His description, I have no doubt, will be acceptable to many of your readers, and it may even furnish useful hints to a more enlightened community.

The makers of these canoes, procure, if possible, a tree with a bend, to form the bow, as this makes a much stronger bow than when it has been cut out of crosswood. After taking off a slab from the side which is intended to be the upper part of the canoe, they commence digging out the inside, taking care not to come within four or five inches of what is intended to be the inside when finished. A cross section of her at this stage of the work, resembles the Grecian letter c laid on its back, as seen in fig. 4. The outside is now roughly formed; and this having been done, she is mounted on two supports, each having a cleft end, formed like fig. 5. These are fixed in the earth, at such a distance from each other that the intended canoe may rest with her two ends in the clefts, and be thus elevated above the ground. She is now filled with water, and fires are kindled under her bottom, the effect of which ingenious arrangement is to increase her width. The inside surface expanding by the water, and the outside being contracted by the heat of the fire below. After she has been spread out in this way as far as is considered proper, the sides are prevented from regaining their old position by pieces of wood which are jambed in between them for that purpose. Those who attend to the fire are furnished with a swab, formed of a bunch of wet grass, with which they prevent any part of the canoe from taking fire. The canoe is now allowed to cool, and the digging in the inside is again resumed. This is continued until within an inch of what the thickness of the sides are to be when it is finished. The fires and water are again applied as before: the workmen, by jambing in cross sticks from time to time, both assist in widening, and also in keeping her to the proper form, and she is thus extended to the required width. The finish is now given to the outside, and she is brought to a proper thickness in the sides and bottom by scooping out the remaining part of the inside. The proper thwarts are then introduced, which finishes the process.

ROBERT HART.

Mitchell-Street, 22d Jan. 1826.

ON ENAMEL COLOURS, AND STAINING & GILDING GLASS.

By W. R. Wynn, of Wellington-Place, Vauxhall.

No. I.—ENAMEL COLOURS.

Painting in enamel colours has always been considered very interesting, and one of the most costly productions of art, in every country where practised; but the real preparation of the colours has always been confined to the knowledge of a few persons, who have made a mystery of it, and whatever has been yet published on the subject appears to be chiefly the compilation of writers unskilled in the profession. Many artists of superior talents, in different parts of the country, could practise the art, but for the difficulty of procuring a complete set of good colours; indeed it is extraordinary with what suspicious secrecy the art of making the proper enamel colours had long been conducted. Mr. Wynn was acquainted with several of the best manufacturers, whose colours were used by the most eminent painters on the finest and most elaborate works of the time, who died without ever benefiting their country by publishing their acquirements, or leaving any documents behind them. By a continued perseverance in such secrecy, it certainly was not impossible that the improved state of knowledge in the art might, under unfavourable circumstances, be lost, if some experienced professional person did not seek an opportunity of making it public. It was from these motives that Mr. Wynn sent his treatise on this subject to the Society of Arts; and that it may be made still more generally useful, we give the substance of it, taken from the 35th vol. of their Transactions.

The different qualities or degree of purity in the ingredients as usually met with, will, with the same prescriptions, produce some slight variations in effect, but the best enamel colours may always be obtained with certainty by careful attention to the following receipts.

When metals are dissolved, the solutions should always be perfectly saturated. In making the fluxes, they should be sufficiently melted in the crucibles, so as to flow liquid, and pour out easily.

The various qualities of the material, or surface, on which painting in enamel is performed, require the colours to be adapted to the degree of heat it will bear or require when burnt; and it is generally the practice of the best painters in enamel to use, for the first painting and burning, colours considerably harder than those used in the second painting and burning, the latter being fine soft enamels, in order to finish the work, and give a beautiful smoothness. It cannot but be obvious to every person who uses enamel colours, that the hardening them, if necessary, will be effected by adding more of the colouring matter, or lessening the quantity of flux; and, if required to be more soft, or to stain more when burnt, to add a little more flux, and this is best done by a very soft flux, generally used for this purpose, such as No. 8; but when particular directions are necessary, they will be found mentioned in the receipt for making the colour. It will be better to make a few ounces, at least, of each colour at a time, and they are all to be ground, as soon as made, in water, with a glass muller or a piece of plate glass, and dried before the fire, then scraped off in powder, and kept in bottles for use. When used in painting, they are ground in spirits of turpentine, and thickened with thick oil of turpentine, which quality the fluid oil of turpentine acquires in three or four years.

PREPARATION OF INGREDIENTS.

Flint Powder.

Take pieces of flint which have been burnt white at the chalk-lime burner's; make them clean with hot water and a brush; then throw them red hot into cold water; after having thus treated them two or three times, pulverise them in a biscuit-ware mortar, with a pestle of the same, and then grind them in water on plate glass.

Red Sulphate of Iron.

Sulphate of iron, otherwise called green vitriol, is to be pounded, and placed in an earthenware muffle, till the moisture is evaporated and a gray powder left; which place in a crucible in a charcoal fire, and stir it with a piece of steel bar, till it is of a fine red colour; then let it fall out of the crucible into a pan of cold water, under a chimney, to avoid the disagreeable fumes that arise; when settled at the bottom, wash it in several hot waters, and then dry it for use. The more it is burnt, the darker the red.

Brown Sulphate of Iron.

Take sulphate of iron in lumps, and calcine it in a red charcoal heat, till it becomes of a dark brown, and let it cool in the crucible; afterwards wash it repeatedly in hot water.

Black Oxide of Copper.

Take copper and dissolve it in aqua-fortis, till the acid refuses to take up any more metal; then dilute the solution with water, and add to it some sub-carbonate of potash, dissolved in water; a green precipitate will fall to the bottom, which must be washed in several hot waters; when settled, pour off the superfluous water, and place the green matter at the bottom on a piece of coarse open canvass, tied over a large earthen pan, on which a piece of blotting paper is laid; after the precipitate has been thus drained, it should be taken off, and made perfectly dry by placing the paper on a drawer-full of powdered chalk to absorb more of the moisture, and then placed before the fire. When dry, calcine it in a crucible in a charcoal fire, and throw it red hot into cold water; then rince it in boiling water, and dry at the bottom of the basin before the fire. What remains is a beautiful black oxide of copper.

Green Oxide of Copper.

Take a saturated solution of copper in aqua-fortis, and precipitate it with sub-carbonate of potash; then wash it several times in boiling water, filter and dry it.

White Oxide of Tin.

Into a small wooden box with a sliding cover, chalked over on the inside, pour melted tin from a ladle, and shake the box till the tin becomes finely granulated; then wash it and dry it, and put it into a Florence oil flask, and pour over it strong nitrous acid, which rapidly converts it to a white powder. When a sufficient quantity of this is obtained, it should be well washed in several boiling waters, poured out into a basin, and dried before the fire. It then produces a very white oxide of tin.

Black Oxide of Cobalt.

Take good metallic cobalt,* and dissolve it to saturation in nitric acid, diluted with a little water, in a flask placed in sand over the fire; then pour it into a large basin, and having added a quantity of water, pour in a solution of subcarbonate of soda, as long as any precipitate falls down: when settled, pour off the water, and wash the powder in several hot waters, filter and dry it: when dry, mix it in a biscuit-ware mortar, with a pestle of the same, with three times its weight of dry nitre; place it in a warm crucible, and drop in an ignited piece of charcoal. Some slight explosion will then take place, and when these have ceased, make the calx red hot; this, after being washed and dried, produces the best oxide of cobalt for enamel, and capable of making and compounding various colours.

Fluxes.

Take great care to mix all the ingredients accurately together in a biscuit-ware mortar, with a pestle of the same, and have them all pounded as fine as possible. Let the crucibles be made warm before the fluxes are put into them, by placing them on a fire with the open end downwards, which will prevent most of the accidents which happen by their breaking in the fire.

The best furnaces for making fluxes, or for any other process that requires great or continual heat, is a common German stove, about 18 or 20 inches inside, lined all round from the grating to the top, (except the aperture at the door in the front for the occasional introduction of a muffle,) with one row of fire-bricks set with loam; the iron pipe chimney projects from the back part near the top. The top, or cover of the furnace, to be loose like a lid, and removable by handles; in the centre of it a circular hole is cut out, which is also fitted with a cover, through which the top of the crucible may be lifted off, and its contents be stirred up with a bar of steel. A small piece of fire-brick is placed on the grate for the crucibles to stand on, and the fuel should be charcoal and coke mixed, or charcoal alone.

Flux No. 1.

	Parts by Weight.
Red lead,	8
Calcined borax,*	1½
Flint powder,	2
Flint glass,	6

Flux No 2.

Flint glass,	10
White arsenic,	1
Nitre,	1

Flux No. 3.

Red lead,	1
Flint glass,	3

Flux No. 4.

Red lead,	9½
Borax, not calcined,	5½
Flint glass,	8

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* In the choice of cobalt, that which, when dissolved in nitric acid, gives the purest and deepest red solution, generally makes the finest colours.

* Borax calcined to a dry white calx in a crucible, only a third part of which should be filled at once, on account of the borax swelling so much as it gets off.

Flux No. 5.

Flint glass,	6
Flux No. 2,	4
Red lead,	8

Flux No. 6,

Flux No. 2,	10
Red lead,	4
Flint powder,	1¼

Flux No. 7.

Flux No. 4,	6
Colcothar,	1

Flux No. 8.

Red lead,	6
Borax not calcined,	4
Flint powder,	2

After the fluxes have been melted, they should be poured on a flag stone wet with a sponge; or into a large pan of clean water, then dried, and finely pounded in a biscuit-ware mortar for use.

Yellow Enamels.

	Parts by Weight.
Red lead,	8
Oxide of antimony,	1
White oxide of tin,	1

Mix the ingredients well in a biscuit-ware mortar, and having put them on a piece of Dutch tile in the muffle, make it gradually red hot, and suffer it to cool.

Take of this mixture,	1
Of Flux No. 4,	1½

Grind them in water for use.

By varying the proportions of red lead and of antimony, different shades of colour may be obtained.

Another Yellow.

Take three parts, by weight, of sheet lead and one part of block tin; melt them together in a ladle or a flat shovel, and skim off the top in proportion as it oxidates. When a sufficient quantity is obtained, place it in a muffle in a gentle heat, to reverberate and entirely calcine any remaining particles :

Of which take	7½
Oxide of antimony,	1
Litharge,	1

Mix these well together, and give them a red heat in a muffle to bind them together, but not to melt. Use the same flux as for the other yellow.

Orange.

Take red lead,	12
Red sulphate of iron,	1
Oxide of antimony,	4
Flint powder,	3

Well mixed in the mortar, and calcined so as to stick together, but avoid melting.

Take of the above,	1
Flux No. 7,	2½

Grind for use.

Dark Red.

Take sulphate of iron, calcined dark,	1
Flux No. 7,	3

Grind for use.

Light Red.

Take red sulphate of iron,	1
Flux No. 1,	3
White lead,	1½

Grind for use.

Red Brown.

Take brown sulphate of iron calcined dark,	1
Flux No. 1,	3

Grind for use.

Vandyke Brown.

Take Flux No. 4,	3
Iron filings,	1

Melted together in a crucible, and drawn out with curling tongs;*

---

* In this and in other cases where a muffle is not in readiness, an earthen crucible, washed with flint powder inside, or with dry flint powder, rubbed inside an eighth of an inch thick, may be used, and the materials when partially melted so as to stick together, are completely taken out without loss.

with so much metal it will not pour out freely.

Take of the above,	5
Black oxide of cobalt,	1

Grind for use.

Another Brown.

Take manganese,	2¼
Red lead,	8½
Flint powder,	4

Calcined to stick together.

Of this mixture, take	1½
Of Flux No. 4, and iron filings, melted as above,	1½
Flux No. 4,	1

Grind for use.

Black for Painting, and Mixing with other Colours.

Take of umber, broken into small bits and calcined to a yellow heat in a crucible till quite black, then washed in boiling water and dried,	10
Black oxide of cobalt,	10
Blue flint glass,	10½
Raw borax,	7½
Red lead,	12

Calcine these well together, and

Take of it,	2
Flux No. 4,	1

Grind in water for use.

Blacks are compounded in other proportions of these ingredients, and manganese is sometimes substituted in the place of umber.

Another Black.

Take umber, calcined black,	1
Black oxide of cobalt,	1½
Black oxide of copper,	½
Flux No. 4,	3

Grind these in water, and when dried, place them on a piece of Dutch tile, (washed over with flint powder, ground in water,) in a muffle in a charcoal fire, and calcine them so as to stick together, then add to it ½ of flux No. 4. Both these blacks if too soft are hardened by adding a little black oxide of cobalt.

Black for Shading and Drawing under Greens.

Take manganese,	5
Royal smalt,	1

Ground fine in water, and calcined to a high degree of heat in a muffle.

A beautiful Black, for solid Grounds or inlaying, but does not mix generally.

Take black oxide of copper,	1
Flux No. 4,	2

Grind in water for use.

A Frit for transparent Greens.

Take flint powder,	3
Flux No. 2,	3
Green pot-metal glass,	1½
Red lead,	7½
Raw borax,	2½
Green oxide of copper,	1¼

Melt them in a crucible, pour out the mass, and pound it in an earthenware mortar.

Green.

Take of the green frit,	3
Of yellow enamel colour, made up as before directed,	1½

If too soft, add Naples yellow.

Grind in water for use.

Another Green.

Take of green frit,	5
Flux No. 2,	½
Flux No. 6,	2½

Grind in water for use.

Greens in painting on enamel are formed of various shades by mixing blue and yellow, or blue and orange, &c. in different proportions.

Blue.

Take of black oxide of cobalt,	4
Flint powder,	9
Nitre,	13

Mix them well in an earthenware mortar, and heat them in a crucible in a strong fire of coke and charcoal, till perfectly melted;* then pound the mass, wash it in cold water, and dry it.

Of this take,	1
Flux No. 5,	1

Grind for use.

Another Blue.

Take black oxide of cobalt,	1
Raw borax,	1

Melt them together.

Of this mixture take	2
Blue pot-metal glass,	10
Red lead,	½

Melt them in a very strong fire.

If either blue is too soft, add a little royal smalt; if too hard, a little flux made of blue glass 2, borax, 1.

Purple.

Take fine grain gold from the refiner's, and dissolve it to saturation in aqua-regia of strongest

	Parts by Measure.
Nitric acid,	1
Muriatic acid,	3
Distilled water,	3

Make the solution in a clean Florence oil flask, placed on sand near the fire.

Pour melted tin into cold water, and take of this tin	1
Aqua-regia, diluted with water in the same proportion as above,	4

Place the acid and the tin in a large basin covered with a plate, in a temperate heat; when the tin is all dissolved, add

Tin,	1
Strong red fuming nitrous acid,	1½

and instantly cover the basin with the plate to prevent the fumes from escaping. After standing 24 hours, a little distilled water should be poured into the basin. The solution of tin may then be put into a clean phial for use, adding to it a few grains of tin; examine it after four or five days, when the solution, if carefully made, will be of a fine and clear dark colour, and fit to make the purple with. Then, of the solution of gold, take sufficient to colour distilled water of a faint straw yellow, and drop gradually into it the solution of tin, and a most beautiful purple precipitate will immediately be formed, which must be thrown, as it is made, into a large vessel, and two or three pieces of melted tin should be put at the bottom.

Mix the solution of tin, with that of the gold, in this manner, till the last added drops occasion no turbidness in the liquor; the precipitate is then to be washed in several hot waters, filtered on the blotting paper and canvass, and, while in a moist and soft state, mixed with flux No. 4, finely powdered.

The proportion of flux to the purple precipitate is always various, and is judged of by the mass being of a good rich and dark colour, as the ingredients are ground together on the plate glass. Care must be taken to grind this colour before it gets dry.

Twenty-four grains of gold, made into a precipitate in this manner, will take two ounces of flux, and this may be a rule to the inexperienced practitioner.

Rose Colour.

To a saturated solution of gold in aqua-regia, (containing 24 grains of gold,) diluted with 100 times its bulk of warm distilled water, having 20 grains of alum* dissolved in it, add caustic ammonia, drop by drop, as long as any precipitate is thrown down, which wash in several hot waters.

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* If these preparations are not sufficiently fluid in the melted state to pour out of the crucible, the colour will stick to a piece of steel bar when it is warm, and may be drawn out; and sometimes the blues are made in crucibles lined with flint powder, as before mentioned.

* The rose colour is sometimes made without any alum.

To 24 grains of gold, precipitated in this manner, put

Flux No. 4	2 oz.
Flux No. 3	2 oz.

Mix them together wet, and grind them on a plate glass, adding, by a leaf at a time, 16 leaves of leaf-silver; when the whole is ground fine, let it be dried on the glass, scraped off, and put in a bottle for use.

This rose colour grinds of a gray or slate colour, but after being ground, if placed in a muffle, and exposed to a gentle heat, it will turn to a red, but it is fit for use in either state.

If too yellow, add a little purple; and if too purple, add more leaf-silver.

Another Rose Colour.

Take purple made as before directed,	1 oz.
Flux No. 3,	4 oz.
Muriate of silver,	10 gr.

The latter ingredient is prepared by dissolving silver in aqua-fortis, and precipitating it with common salt.

Grind in water for use; if too purple, add more muriate of silver.

Opaque White.

Hartshorn shavings burnt in a crucible, in a charcoal fire, till perfectly white,	1
Flux No. 1,	1

Grind in water for use.

Venetian white cake enamel,	1
Flux No. 8,	$\frac{1}{4}$

Grind in water, then calcine them together in a muffle.

Flux No. 2, pounded and washed, then dried and calcined in a muffle.

It would not be difficult to fill a volume with descriptions of different tints, by combining these original enamel colours in various proportions; this, however, may safely be left to the taste and experience of the artist. The object has been to avoid every thing superfluous, and at the same time to explain the processes adapted to immediate practice in terms not liable to be mistaken.

GLASGOW MECHANICS' INSTITUTION.

SUBJECTS FOR ESSAYS PROPOSED BY MR. DEUCHAR FOR THE STUDENTS ATTENDING HIS CLASS.

[Continued from page 296 of the present Volume.]

19. When we remove the whole of the water from one of the balls of the cryophoxus, and put it (when it thus appears quite empty) into a freezing mixture of snow and salt, two rather extraordinary phenomena present themselves: 1st, The water in the other ball, at four feet distance from the freezing mixture, is frozen. 2d, When we examine the interior of the ball exposed to the cold, it is covered over with drops of moisture. Why does the water at a distance freeze, whilst that in contact with the cooling agent remains liquid?

20. Since it is a general result that chemical combination produces a rise of temperature, how do we account for the cold resulting from freezing mixtures?

21. How does it happen that steam at 212° will scald the hand more than steam at 230°; and that air at 240° may be borne with impunity?

Solutions to several of the questions formerly proposed.

At the close of the lectures on the 24th and 25th January last, Mr. Deuchar exhibited and explained, in his respective classes, three of the questions formerly given out; at the same time he intimated, that although several of the solutions of these which had been transmitted him by his pupils displayed great ingenuity, yet none of them were quite correct. The solutions given by Mr. Deuchar, so far as we could get them taken down, were,

To question 1st, (page 264,)—From the facility of movement which is communicated to a sewing needle, by floating it on water, it follows, in consequence of the continually operating effect of the magnetism of our earth, that it should turn round till it points north and south. But it has also been required why the point of the needle, in preference to the eye, turns to the north. It is probable that the law which holds true in regard to the superior effect of sharp points in attracting electricity, also applies to magnetism; if this be the case, we have it at once explained why the point of the sewing needle turns to the north—because it is the nearer pole, and will therefore operate most powerfully.

To question 4th, (page 264,)—In the water hammer, the water has been boiled till the steam formed has expelled the whole of the air, and what is by many imagined to be a vacuum is formed; therefore, the enclosed water in moving up and down has not the resistance of the air to impede its progress, and is enabled to fall at once, and produce the noise from which the instrument gets its name. This proves the solidity and hardness of the particles of the water.

To question 5th, (page 264,)—In the water hammer we have an appearance similar to boiling shown when we apply the heat of the hand; philosophers were long of opinion, and it is still vulgarly imagined, that here we have the confined water actually boiling, but the phenomenon arises from another cause. Whenever a fluid is placed in contact with a vacuum, a portion of the fluid rises in vapour and occupies that vacuum. Now, when we apply the heat of the hand to the water hammer, the vapour or steam becomes expanded, and presses through the water towards the other end of the hammer, where the vapour yields to the pressure; but in passing through the cold water, it gives out the heat it had received from the hand, and looses its power of resisting (by its temporary increased elasticity) the continued expansion of the vapour in contact with the end held by the hand; therefore, we have a succession of expansions at the one end, and contractions at the other, which give the appearance of boiling. The same explanation applies to the narrow necked water hammer, for when using it, the heat communicated to the tube, either from the friction of the hand or otherwise, operates in the same way as if we continued to apply the hand itself.

ARITHMETICAL QUESTION.

"Even when we trifle, Truth should bear the palm."

[ALTHOUGH we are most unwilling to fill our pages with questions of no utility, such as the arithmetical sophism which our Correspondent notices in the following communication we insert it, and chiefly because it shows the inutility, we may say folly, of attempting to multiply things by things.]

Gentlemen,—Should the following obtain publicity through the medium of your highly valuable miscellany, I shall think myself excused for presuming to send it.

A few days ago, the *first* volume of the London Mechanics' Magazine was put into my hands, and in perusing it I could not but notice an "Arithmetical Question," which is there said to have engaged much attention upon 'Change and in the Coffee-houses for a number of years; and now the pages of that work are said to reflect a "blaze of light"* upon the subject, without bringing it, in my humble opinion, to a satisfactory conclusion.

By fractions† $£99\ 19\ 11\frac{3}{4} = 99 + \frac{19}{20} + \frac{11}{12}$ of $\frac{1}{20} + \frac{3}{4}$ of $\frac{1}{12}$ of $\frac{1}{20} = 99 + \frac{19}{20} + \frac{11}{240} + \frac{3}{960} = 99 + \frac{46032}{46080} = \frac{4607952}{46080}$.

$$\text{But } \frac{4607952^2}{46080^2} = \frac{2123321634304}{2123366400} = 9999 \text{ and } 1681000704 \text{ remains.}$$

$$\text{And } \frac{1681000704}{2123366400} \times 20^2 = \frac{6724002816}{21233664} = 316 \text{ and } 14164992 \text{ remains.}$$

$$\text{Also, } \frac{14164992}{21233664} \times 12^2 = \frac{2039758848}{21233664} = 96 \text{ and } 1327104 \text{ remains.}$$

$$\text{Again, } \frac{1327104}{21233664} \times 4^2 = \frac{21233664}{21233664} = 1 \text{ and no remainder.}$$

So £9999.316*s.* 96*d.* 1 farthing is the answer in its rational square form.

This is one (but not the shortest) of several methods by which this, or any question of the same nature, may be performed, and in this case double the number of farthings in the given sum, and one more for the corner of the square, added to the answer will make £10,000, bearing in mind that 16 farthings make one penny, 144 pence one shilling, and 400 shillings one pound. This I humbly conceive to be the *rationale* of multiplying sums, consisting of different denominations by each other. To contrast *simplicity* with *abstruseness* in an almost useless subject, is the chief intention of

Yours, &c.

K. Child.

Ovenden, Yorkshire, 31st Dec. 1825.

P. S. I had seen the more recent parts of this work, before I saw the volume to which reference is made as above. Your candour, Gentlemen, will excuse a rough sketch done in much haste, in order that an acquaintance going to Glasgow might take it with him. Had time permitted, some remarks might have been made on the similarity between questions of this kind, and squaring, &c. (or multiplying,) yards, feet, inches, and fractions of an inch; and hence a more rational method deduced, of measuring or of expressing the measurement of land and some other things, which is deferred till another opportunity. K. C.

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* See remarks by the Editor, vol. 1, p. 437.—And do not the columns of that work exhibit two many of such "blazes," while the purchaser pays for, and the reader spends his time with much matter of little value, for which vide Balance Question, Screw-driver, &c. also vol. 3, p.p. 196, 329, &c. and vol. 4, p.p. 74, 296, 300, 345, &c. &c.

† See question, vol. 1, p. 269, proposed by W. P.

NATURAL HISTORY.

The Bat.—Some workmen engaged in opening a vault in our church-yard, were surprised, and, we believe, in some measure startled, by the squeaking of an animal which dropped from the roof of the dormitory, and which, on inspection, proved to be a bat; it appeared lifeless when laid hold of, but, on being brought to the open air, gradually recovered. This circumstance is singularly remarkable, for the fact of the vault having remained unopened for the space of ten years and upwards, and no crevice or aperture being discovered in its thick-ribbed walls, the creature having in all probability existed in this confined and tainted region during the whole of that period.—*Bury Gazette.*

The March of Caterpillars.—The naturalist may perhaps be interested by being informed that our route was crossed in this place by a singular procession; it consisted of upwards of a hundred large black caterpillars, which were performing their migration from one spot to another. They were led by three ranks, two deep; the remainder followed in line, each taking hold of the rear of his predecessor and performing their movements at the same moment; the rear was again closed by three lines, two deep, and the whole moved on slowly, but with extreme precision, across our path. — *Emerson's Picture of Greece in* 1825.

FOURTH REPORT OF THE EAST LOTHIAN ITINERATING JUVENILE AND VILLAGE LIBRARIES, 1824 and 1825.

The object of this Institution is to furnish all the Towns and Villages of the County with Libraries of useful books. The books are arranged into Divisions of fifty volumes, which are stationed in a place for two years, where they are issued gratuitously to all persons above twelve years of age who agree to take care of them; after this period they are removed, or exchanged with other Divisions.

The Institution is chiefly supported by the subscriptions and donations of benevolent individuals, Societies, and Annual Reading Subscribers of three shillings and upwards. In order to increase the number of Reading Subscribers, *New Books* to double the amount of their subscriptions are procured, and kept for their use for one or two years. They are also entitled to order books to be purchased to double the amount of their subscriptions. The Committees of Societies giving donations, are also entitled to the use of the new books.

Report for 1824 *and* 1825.

Another period having arrived for the general change of the Divisions of the East Lothian Itinerating Libraries, the following account of the progress of the Institution is laid before its friends and the public.

Since the last Report, dated December 1823, five new Divisions, consisting of 250 volumes, and an Agricultural Branch, consisting of 100 volumes, have been added to the Institution, which now consists of

twenty-four Divisions of fifty volumes each, in all,...	1200	vols.
Agricultural Branch, ...	100	do.
New Books at Haddington for the use of Subscribers,......	104	do.
New Books at North Berwick, for the use of Subscribers at that place,....................	71	do.
Donations, &c. not yet united to any Division, ...	23	do.
Making in all, ...	1498	vols.

In 1824, a Division was sent from the Parent Library to Society, near Penston, and this year (1825) three Divisions have been sent to new stations; one of which has gone to Tranent, at the request of the Committee of the Tranent Bible and Missionary Society, another to Linton, and the third to Bolton, to meet the wishes of two liberal contributors to the Institution. The fourth is nearly ready to send to any place where a zealous Librarian can be found, only giving a preference to any station recommended by a Subscriber, or by a Society giving a donation.

As the books last year at Society were not fully occupied, only the half of a Division has been sent to that place this season, and the other half has been sent to Elphiston; and next year these two halves will be exchanged with each other.

The issues of the books, and the voluntary donations of the readers put into the Library boxes, from October 1823 to Sept. 1825, were as follows:—

STATIONS.			1824.		1825.		Donations put into Library Boxes in two Years.	LIBRARIANS.
			Readers.	*Issues.*	*Readers.*	*Issues.*		
Haddington, ...	4 Divisions,	200 vols.	264	1169	216	1080	£0 5 8	Mr. Samuel Brown.
Salton, ...	1 ditto	50 do.	63	360	37	314	0 2 1½	Mr. Watherston, teacher.
Aberlady, ...	1 ditto	50 do.	45	375	12	14	0 10 1½	Mr. Walker, weaver.
Tynningham, ...	1 ditto	50 do.	40	198	35	134	0 1 2	Mr. Dickson, teacher.
Prestonpans, ...	1 ditto	50 do.	26	86	21	65		Mr. Pearson, shoemaker.
Whittingham, ...	1 ditto	50 do.	18	87	7	27	0 1 1	Mr. Young, teacher.
North Berwick, ...	2 ditto	100 do.	126	741	110	699	0 5 0	Mr. James Dall, draper.
West Fenton, ...	1 ditto	50 do.	38	131	10	37	0 2 8	Mr. John Hogg, labourer.
Kingston and Merrylaws,	1 ditto	50 do.	8	13	23	68	0 2 4	Mr. James Brown, smith.
Dunbar, ...	1 ditto	50 do.	62	263	21	53		Mr. Lawson, shoemaker.
Athelstaneford, ...	1 ditto	50 do.	33	150	21	122	0 5 0	Mr. Peter Brown, wright.
Long Niddry, ...	1 ditto	50 do.	32	224	20	160	0 14 1½	Mr. Peter Dickson, wright.
Ormiston, ...	1 ditto	50 do.	33	117	5	10	0 3 7	Mr. Begg, teacher.
Pencaitland Coalworks,...	1 ditto	50 do.	44	240	17	57	0 0 2	Mr. William Gray, collier.
Gifford, ...	1 ditto	50 do.	89	400	27	143	0 9 10½	Mr. Porteous, sadler.
Society, ...	1 ditto	50 do.	one	year.	34	74	0 1 9	Mr. Adam Wilson, tailor.
		1000 vols.	921	4554	616	3057	£3 4 8	

The Libraries are continued at all the above places, and Divisions have this year been sent to the following New Stations.

Tranent, ...	1 Division,	of 50 vols.	Mr. Wm. Watt, jun. smith.
Linton, ...	1 ditto	50 do.	Mr. John Porteous, sadler.
Bolton, ...	1 ditto	50 do.	Mr. Thomas Lamb, teacher.
Elphiston, ...	½ ditto	25 do.	Mr. Foggo, teacher.

By the preceding statement, it will appear, that allowing a month for the perusal of a volume, there has been issued, on an average, during the last two years, 317 volumes monthly, out of 1000 volumes, the number of books belonging to the gratuitous part of the establishment, during that period; which is a proportion of issues unexampled in any Stationary Library of the same standing. And it is deserving of remark, that the number of issues in the first four villages where Divisions have been placed for eight years, the issues have not been much fewer during the last two years than during the first, when the influence of novelty may be supposed to have induced many to apply for books.

From the Haddington Divisions, the prison of the town, and two Sabbath Schools in the neighbourhood, and from those at North Berwick, the crews of four sloops belonging to that port, have, as formerly, been supplied with books.

Although a large proportion of the books in these Libraries have been on the subject of religion and morals, because these are matters in which every individual is most deeply interested, yet a considerable number relate to history, travels, biography, and the arts and sciences, and some attention has been paid to procure books that were calculated to excite the attention of young persons, and form in them a taste for reading, observation, and reflection. The Manager has in his eye some in whom these habits have been formed in no ordinary degree, and he has reason to believe the books they read from this Institution have had no inconsiderable influence in forming these habits; but delicacy to living characters prevents him from being more specific.

There was, however, an instance, which may be stated, of the books being of great advantage to a young man in very peculiar circumstances. He lost his hearing in his childhood, and his speech was gradually so much affected, that he could with great difficulty make himself intelligible to others; and, in consequence, he was unable to obtain information, by oral instruction, on religious, moral, or scientific subjects. Happily for him, he had learned to read before this calamity came upon him. He had a mind much superior to his situation and circumstances, which led him eagerly to embrace the advantages of this Library for the last eight or ten years of his life; and such was his enjoyment from books, that after working all day as an apprentice to a shoemaker, he would often sit up very late reading such books as he could not otherwise have procured, or perhaps ever have heard of. At one time his mind was much engaged in conjecturing the causes of day and night, summer and winter, when he took out a volume on Astronomy from the Library, which gave him the information he wanted, and which filled him with wonder and delight. Pointing to his forehead, and clapping his breast, he said, "Science fine!" On the establishment of the Haddington School of Arts, he deeply regretted his inability to hear the Lectures; but on the formation of a Scientific Library in connection with that Institution, he cheerfully became a subscriber, notwithstanding his very limited means, and after this he usually at the same time took out a scientific book from that Library, and a religious one from the other. He was taken ill of consumption, which soon terminated in his death.

From a conviction, that to excite the farm servants and agricultural mechanics of the county, to observe and attentively to reflect on the various objects with which their employments bring them into immediate contact, would be to render an important service both to them and to their employers, the Manager endeavoured to introduce into the Libraries already in circulation several Works on Rural Affairs; but the funds he could appropriate to that purpose being very limited, he presented an application to the United Agricultural Society of East Lothian, for a donation to purchase books on agricultural subjects—an application to which that respectable association kindly attended, and voted a donation of five guineas. This grant has been employed in the purchase of certain books recommended by an intelligent member of the Committee of that Society. A few pecuniary subscriptions for that object have been received, besides donations of books.

This branch now consists of one hundred volumes; and it will gratify its friends to be informed, that as soon as the catalogues of the books which it contains were circulated, and it was announced that they would be issued gratuitously to farm servants and mechanics, there were many applications for them, particularly for those on agricultural implements, and that still a great anxiety for their perusal is evinced by individuals whom they are fitted to improve and interest.

All the Librarians continue to give their services gratuitously, and the usefulness of the Institution depends in a great measure on the cheerfulness and activity with which they discharge their office; and indeed it could not be carried on without their voluntary services, but at an expense which would greatly retard its progress.

General State of Accounts from 1823 *to* 1825.

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To Balance due to the Manager,	4	9	1
	£89	2	0

DISBURSEMENTS.

	£	s.	d.
Balance due to the Manager at last settlement,	18	9	8
By paid for Books for General Branch,	38	0	4
By paid for binding and repairs of books for ditto,	8	14	1
By paid for Book-cases,	3	6	8
By paid for printing Report, Catalogues, and Labels,	5	13	5
By carriages, and other incidents,	1	17	8
By paid for Books for Agricultural Branch,	5	0	3
By binding for ditto,	1	19	7
By printing Circulars, Catalogues, and Labels for ditto,	6	0	4
	£89	2	0

MISCELLANIES.

Song Birds.—The delightful music of song birds is perhaps the chief cause why these charming little creatures are in all countries so highly prized. Music is an universal language; it is understood and cherished in every country; the savage, the barbarian, and the civilized individual, are all passionately fond of music—particularly of melody. But delightful as music is, perhaps there is another reason that may have led man to deprive the warblers of the woods and fields of liberty, particularly in civilized states, where the intellect is more refined, and, consequently, the feelings more adapted to receive tender impressions—we mean the associations of ideas. Their sweet melody bring him more particularly in contact with groves and meadows—with romantic banks or beautiful sequestered glades—the cherished scenes, perhaps, of his early youth. But, independent of this, the warble of a sweet song bird is in itself very delightful; and to men of sedentary habits, confined to cities by professional duties, and to their desks most part of the day, we do not know a more innocent or more agreeable recreation than the rearing and training of these little feathered musicians.—*Treatise on British Song Birds.*

Diving.—I have always, says the late Dr. Jenner, in his Essay on Migration of Birds, been much attached to that faithful animal, the Newfoundland dog, and have often procured from that country those dogs that had been much accustomed to diving, and which had been kept to the practice; yet I never observed that any of them attained, by habit, the power of remaining under water longer than thirty seconds; and even then, on rising to the surface, they appeared confused. Negroes, and other men who have been employed in seeking among sunken rocks the hidden treasures of the deep, are said to have acquired a habit of remaining some minutes under water, but the time was probably measured by a rude guess, and not by a stop watch.

Published every Saturday, by W. R. M'Phun, 155, Trongate, Glasgow, to whom
Communications (post paid) must be addressed.

CURLL, PRINTER.

THE GLASGOW
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No. CXII. *Saturday*, 11*th February*, 1826. Price 3*d*.

APPARENT DIRECTION OF THE EYES IN A PORTRAIT.

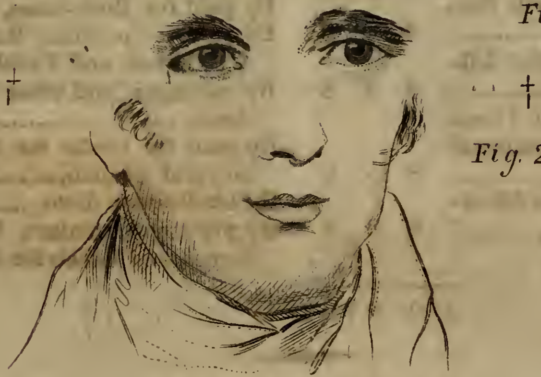

Fig. 1.

Fig. 2.

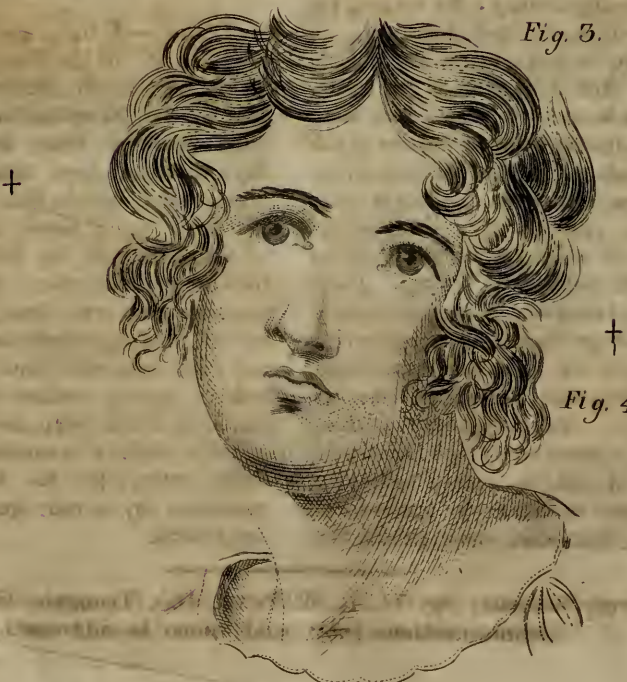

Fig. 3.

Fig. 4.

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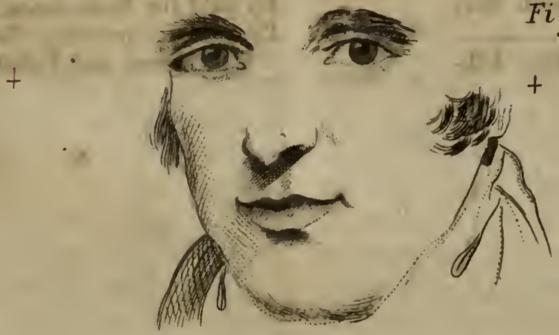

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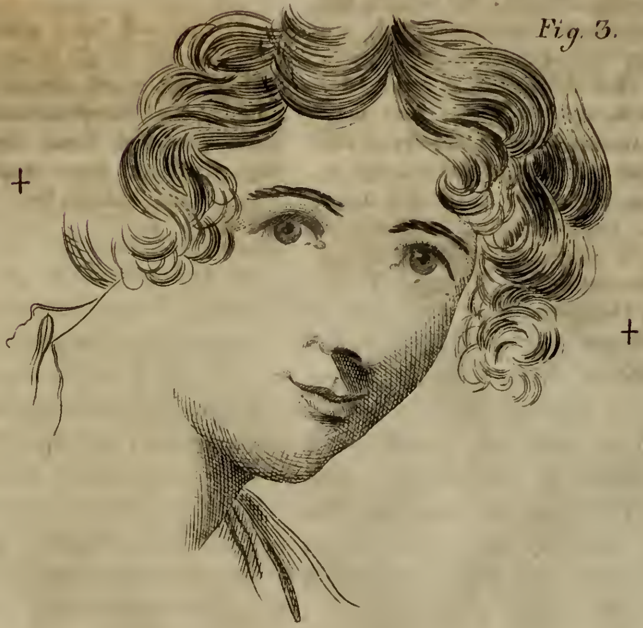

Fig. 3.

–Swan. Sc.–

ON THE APPARENT DIRECTION OF THE EYES IN A PORTRAIT.

By William Hyde Wollaston, M. D., F. R. S., and V. P.*

When we consider the precision with which we commonly judge whether the eyes of another person are fixed upon ourselves, and the immediateness of our perception that even a momentary glance is turned upon us, it is very surprising that the grounds of so accurate a judgment are not distinctly known. Though it may not be possible to demonstrate what these are by experiments on the eyes of living persons, we may find convincing arguments to prove their influence, if it can be shown, in the case of portraits, that the same ready decision we pronounce on the direction of the eyes is founded, in a great measure, on the view of parts which, as far as I can learn, have not been considered as assisting our judgment.

One might imagine that the circular form of the iris would be a sufficient criterion of the direction in which an eye is looking, since, when the human eye is looking at us, this part is always circular, but cannot appear strictly so when turned in such a manner that we view it with any degree of obliquity. But we cannot judge of exact circularity with sufficient precision for this purpose, even when the whole circle is fully seen, and in many cases we see too small a portion of the circumference of the iris to distinguish whether it is circular or elliptic. In a portrait, though the iris be drawn truly circular, and consequently appear so in a direct view, still in oblique positions it must be seen as an ellipse; and the eyes continue to look at the spectator, though he views them very obliquely, and sees them of a form most decidedly elliptic.

If we examine the eyes of a person opposite to us, we find the most perceptible variation in the appearance of his eyes, in consequence of their lateral motion, is an increase and decrease of the white parts at the angles of each eye. In the central position the two portions are nearly equal. By this we decide that a person is looking neither right nor left, but straight forward in the direction of his nose. If he turn his eyes to one side, we are made sensible of the change by a diminution of the white of the eye, by which alone we are able to estimate in what degree they deviate in *direction from the face to which they belong*.

But *their direction, with reference to ourselves,* is perfectly distinct from this. In judging of which, even in real eyes, we are not guided by the eyes alone, but are aided by the position of the entire face. In a portrait, this can be proved by experiment. If a pair of eyes be drawn correctly, looking at the spectator, unless some touch be added to suggest the turn of face, the direction of the eyes seems vague, and their direction will not appear the same to all persons. To the same person they may be made appear directed either to him or from him by the addition of other features strongly marking that essential circumstance the *position of the face.*

In fig. 1 of the engraving, the eyes appear to be decidedly looking at the spectator; in fig. 2, a set of features oppositely turned are so applied to the same eyes, that they look considerably to the right of the person viewing them. In fig. 1, the position of the face being at a certain angle to our left, the eyes, which are turned at an equal angle from that position, seem pointed to ourselves. In fig. 2, the deviation of the face from us being toward the same side as the turn of the eyes, gives additional obliquity to their apparent direction, and carries them far to the right of us. It is clear, in forming our judgment as to the apparent position of the face, we are principally influenced by the nose and other parts of it most prominent, because these are subject to the greatest changes of perspective, by alteration of position.

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* This article is abridged from the Transactions of the Royal Society for 1824.

The perspective form which correctly represents a certain pair of eyes in one position of the face, cannot be an exact representation of the *same* eyes in another; but in cases of such slight obliquity as is usually given to the eyes in a portrait intended to look at the spectator, the variation of the form of the lids from obliquity is less than the difference observable in the eyes of different persons. Hence, a pair of eyes drawn looking at us, best admit of being warped from their intended direction by a new position of the other features of the face.

The converse of this may also be shown. Eyes drawn originally looking a little to one side, may be made to look at us by applying other features in a suitable position. But although a change of 20 or 30 degrees may be effected, a turn of 90 degrees cannot be produced. If an attempt be made to carry the experiment beyond reasonable limits, so that the perspective form of the eyes is glaringly ill suited to the rest of the face, the effect is impaired, but not altogether lost. Some persons much accustomed to drawing the human eye, who are in the habit of attending minutely to the shape of the lids, may not feel the full effect perceived by others; but still the change of direction that is admitted by the generality of those who have nothing to warp their judgment, shows how little influence the eyelids really have in giving apparent direction in comparison with the more prominent features.

The same principles which apply to the *lateral* turn of the eyes and face, apply also to instances of moderate inclination of the face upwards or downwards. For, when the face is pointed downwards, the eyes looking at us must be turned upwards from the position of the face to which they belong. And if to eyes, so drawn, an upward cast of features be substituted for the former, the eyes seem immediately to look above us.

When the turn of a pair of eyes partakes of both inclinations, so as to be in a direction laterally upwards, the alteration produced by changing the position of the face, affords the most striking exemplification of the force of this principle, as may be seen in figs. 3 and 4 of the plate.

But the effect thus producible is by no means limited to the mere extent of deviation, as a total difference of character may be given to the same eyes by due representation of the other features. A lost look of devout abstraction in an uplifted countenance may be exchanged for an appearance of inquisitive archness, in the leer of a younger face, turned downwards, and obliquely toward the opposite side. The under eye-lid, which in the former position conceals a portion of the ball of the eye, from an effect apparently of mere perspective, will in the latter seem raised with effort, and thus give the appearance of a smile to the same eyes, if supported by corresponding expression of the rest of the countenance. These instances sufficiently show, that the apparent direction of the eyes to or from the spectator, depends upon the balance of two circumstances combined in the same representation, namely, 1st, The general position of the face presented to the spectator; and 2d, The turn of the eyes from that position.

With this previous knowledge of the influence which the general perspective of the face in a portrait has upon the apparent direction of the eyes, we shall be prepared to examine why, if they look at the spectator when he stands in front of the picture, they follow, and appear to look at him in every other direction.

If we consider the effect produced by our change of position with reference to any other perspective drawing, we find a similar permanence of apparent position of the objects represented with respect to ourselves, and corresponding change of direction with reference to the plane of representation, or to the room in which it hangs; and we shall be able, in this case, distinctly to trace its origin in the simplest principles of perspective drawing.

When two objects are seen on the ground at different distances from us in the same direction, one will appear, and must be represented exactly above the other. The line joining them is an upright line on the plane of the picture, and represents a vertical plane passing through the eye and these objects. When objects that are at different elevations are said to be in a line with us, the strict meaning is, that they are so placed that a vertical plane from the eye would pass through them. Now, since the upright line (drawn or supposed to be drawn on the plane of the picture, and representing a vertical plane) will be seen upright, however far we move to one side, and will continue to represent a vertical plane, it follows that the same set of objects, even in the most oblique direction in which the representation can be viewed, are still in the same vertical plane, and, consequently, will seem still to be in a line with us, exactly as in the front view; seeming as we move to turn round with us, from their first direction, toward any oblique position that we may choose to assume.

In portraits, the phenomena of direction with reference to the spectator, and corresponding change of apparent position in space when he moves to either side, depend precisely on the same principles. A nose drawn directly in front, with its central line upright, continues directed to the spectator, although viewed obliquely: or, if the right side of the nose is represented, it must appear directed to the right of the spectator in all situations; and eyes that turn in a due degree from that direction toward the spectator, so as to look at him when viewed in front, will continue to do so when viewed obliquely.

In any extended drawing, the lines of direction admit of being clearly marked in the relative position of objects at different distances; but in portraits the circumstances are less distinct for want of some visible mark indicating the direction of the eyes. But if any object be represented in front of the picture, so that the centre of one of the eyes may appear to be exactly over it, we have then a marked line of direction, which, by its permanently vertical position, renders the relation of the appearances in a portrait to the corresponding phenomena in extended views complete.

NEW SALT MANUFACTORY.

[From the Liverpool Mercury.]

In the manufacture of salt for exportation at Liverpool, which manufacture is principally carried on near the centre of Cheshire, two very costly inconveniences are experienced. The fuel has to be conveyed, by canal, from the collieries around St. Helen's, at a charge of about five shillings per ton; and the salt, after being prepared at the works, has to be conveyed to Liverpool, at the expense of three shillings per ton for freight, and one shilling per ton for river dues on the Weaver. These charges, calculating that half a ton of coal is used in the manufacture of each ton of salt, amount to six shillings and sixpence per ton upon the article when at Liverpool, over and above the actual cost of the materials themselves, the workmanship, and the profits of the salt proprietors.

To avoid these expenses, or the greater part of them, and thereby to reduce the price of salt for export, is the object of a plan now brought forward by our distinguished and energetic Mr. Cropper; and when the beneficial effects of the reduction in price which has recently taken place in consequence of the destruction of a mischievous monopoly, are duly considered, the advantages of still greater reduction in the price of this important article of commerce will be too evident to require pointing out.

Mr. Cropper's plan is to establish salt works on the Lancashire side of the Mersey, a few miles from Runcorn, so as to be within a short distance of the St. Helen's and other collieries, from which coals may be cheaply conveyed upon rail-roads or otherwise; while from the works themselves (to be supplied with brine in the manner hereafter stated) the manufactured salt might be carried to Liverpool at a very trifling cost indeed.

The principal, and indeed a novel feature of Mr. Cropper's project, relates to the conveyance of the brine from its original subterranean pits in Cheshire to the proposed works; and this he suggests may be done by means of an iron pipe underground, extending from the former to the latter place, and passing, of course, beneath the shallow part of the Mersey near Runcorn. At first this appears somewhat startling, but it must be considered that distance alone presents no impediment to the flowing of water.*

We have, in Liverpool, two Water Companies, each of whom have pipes laid in our streets to the extent of more than thirty miles; and from surveys already made relative to Mr. Cropper's plan, it appears that a constant flow of brine from the pits to the works may be secured at the rate of 1,600,000 tons per annum, through a pipe of twelve inches diameter, having a fall of six feet four inches to a mile, the brine moving at the rate of one mile per hour. From this quantity of brine, which would be conveyed at an expense of about one penny per ton per eight miles, 400,000 tons of salt would be produced. The cost of the execution of this plan, so far as it relates to the main pipe and the engines for pumping up the brine from the deep reservoir at the works, when ready for use, is estimated at £65,000; and it is computed that the saving upon the quantity of salt exported from Liverpool, would be from £60,000 to £80,000 annually. In this estimate the erection of the works themselves is, of course, not included, as the expense of new works would be much the same in any suitable situation.

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* We understand that, in Germany, salt brine has for some time been thus conveyed for many miles; a fact of which Mr. Cropper was not informed until long after he had conceived the idea here stated, and had mentioned it to his friends. The fact, however, proves the entire practicability of the plan.

ON ENAMEL COLOURS, AND STAINING & GILDING GLASS.

By W. R. Wynn, of Wellington-Place, Vauxhall.

No. II.—THE ART OF STAINING GLASS.

In *coloured glass*, the whole body of the material is tinged throughout by means of some colouring ingredient uniformly diffused through, or dissolved in, the substance of the glass.

In *enamelling*, the colours, being ground up with an easily vitrifiable flux, are laid on the surface of metal, or porcelain, or glass, and are then exposed to such a degree of heat as shall just melt the enamel, and then fix it on the surface of the substance on which it has been applied.

In *staining glass*, the colouring ingredients are mixed with water, or some other fluid vehicle, by means of which they are spread over the surface of a plate of glass, and when dry, are exposed to such a degree of heat, as by experience has been found to be sufficient. The colour is then rubbed off from the surface of the glass, to which it does not adhere; and those parts of the plate which have been thus covered are found to have acquired a permanent and transparent tinge or stain, doubtless from some particles of the colour having been absorbed, and fixed in the pores of the glass.

In all the compositions for staining glass, silver, in some form or other, enters as an essential ingredient; I shall, therefore, begin by describing the different preparations of silver that I make use of.

Take 2 or 3 ounces of pure nitric acid; dilute it with three times its bulk of distilled water; put it into a Florence flask, or any other convenient glass vessel, and add to it refined silver, by small pieces at a time, till the acid, though kept at a warm temperature, refuses to dissolve any more. After standing quiet for some hours, pour off the clear liquor in a clean ground stoppered phial, and label it *Nitrate of Silver.*

Preparations of Silver.

No. 1. Dissolve common salt in water, and add nitrate of silver drop by drop, till it ceases to occasion any precipitate; there will thus be obtained a heavy white curd-like substance, which must be well washed in hot water, and dried; by exposure to light, it becomes of a dull purple colour. It is known by the name of muriate of silver, or *luna cornea.*

No. 2. Dissolve subcarbonate of soda in water, and add nitrate of silver, as above described. The white precipitate thus obtained, when washed and dried, is ready for use. It is called the carbonate of silver.

No. 3. Dissolve subcarbonate of potash in water, and proceed precisely as directed for No. 2. The white powder thus obtained is also carbonate of silver.

No. 4. Dissolve phosphate of soda in water, and proceed as already mentioned. The precipitate thus obtained is of a yellowish colour, and is called phosphate of silver.

No. 5. Take any quantity of pure silver rolled out into thin plates, and put it into a crucible, together with some sulphur. When the crucible has been a short time on the fire, the sulphur will first melt, and then will gradually burn away with a blue flame. When the flame has ceased, add some more sulphur, and proceed as before; then take the silver out, and heat it red in a muffle; it will now be white, and very brittle; and after having been reduced to powder in a mortar, is fit for use.

No. 6. Take any quantity of a dilute solution of nitrate of silver, and put into it a stick of metallic tin; warm it a little, and the silver will be precipitated in the form of metallic leaves on the surface of the tin. Scrape it off, wash it in warm water, dry it, and grind it in a mortar.

No. 7. Take any quantity of nitrate of silver, and put into it a piece of copper plate; then proceed precisely as in No. 6.

The foregoing preparations of silver mixed with other ingredients, in the proportions about to be described, compose all the varieties of pigment which are requisite for staining glass.

Yellow.

	Parts by Weight.
Take silver No. 2, ...	1
Yellow lake, ...	1

Mix the ingredients and grind them well, with oil of turpentine mixed with thick oil of turpentine; lay it on thin.

Take silver No. 1, ...	1
White clay precipitated from a solution of alum by subcarbonate of soda, ...	3
Oxalate of iron prepared by precipitating a clear solution of sulphate of iron by oxalate of potash, ...	3
Oxide of zinc, ...	2

Let the silver be ground first in water with the oxide of zinc, and then with the other ingredients. This is intended for floating on thick.

Take silver No. 3, ...	1
Yellow lake, ...	1

Grind them in spirit of turpentine and oil, and lay the mixture on very thin.

Take silver No. 4, ...	1
Yellow lake, ...	1
White clay, ...	$\frac{1}{2}$

Grind them in spirit of turpentine and oil, and lay the mixture on thin.

Orange.

Take silver No. 6, ...	1
Venetian red and yellow ochre, equal parts, washed in water, and calcined red, ...	2

Grind the ingredients in spirit of turpentine, with thick of do., and lay the mixture on thin.

Take silver No. 7, ...	1
Venetian red and yellow ochre,	1

Grind in turpentine and oil, &c. as the foregoing. If entire panes of glass are to be tinged orange, the proportion of ochre may be greatly increased. The depth of the tinge depends in some measure on the heat of the furnace, and on the time that the glass is exposed to it, which, though easily learned by experience, cannot be made the subject of precise rules.

Red.

Take silver No. 5, ...	1
Brown oxide of iron, prepared by heating scales of iron, then quenching them in water, reducing them to a fine powder, and lastly, calcining it in a muffle, ...	1

Grind the ingredients with turpentine and oil, and lay the mixture on thick.

Take of antimonial silver, prepared by melting together one part of silver and two do. of crude antimony, and pulverizing the mass, ...	1
Colcothar, ...	1

Grind the ingredients in turpentine and oil, and lay the mixture on thick.

Take of antimonial silver, prepared as above, ...	1
Venetian red and yellow ochre, of each	1

Grind, &c. as before.

When the whole panes of glass are to be tinged, the proportions of ochre and colcothar may be increased, and the ingredients should be ground in water.

Of laying on the Colour.

The method practised by most stainers of glass is to draw an outline in Indian ink, or in a brown colour, ground with turpentine and oil, and then to float on the colour thick, having previously ground it with water. But in this way of proceeding, it is very subject either to flow over, or to come short of the outline, and thus render the skill of the draftsman of little effect.

My method is to draw the pattern in Indian ink, and having ground the colour as fine as possible in spirits of turpentine, brought to a proper consistence with thick oil of turpentine, to add a little oil of spike lavender, and to cover the outline entirely with this composition.

When it has become dry, I work out the colour with the point of a stick and a knife from those parts that are not intended to be stained, and am thus enabled to execute the most delicate ornaments and most intricate designs with exactness and precision.

If the colour is required to be laid on so thick that the outline would not be visible through it, let the colour be first laid on as smoothly as possible, and when it has become dry, draw the outline upon it, with vermilion water-colour, and work out the design as before.

Besides the precision acquired by the above method, it enables the artist to apply different shades in the same design; whereas the old method of floating only communicates a uniform tint to the whole pattern.

The artist should contrive to charge his furnace with pieces, the colour of which is ground in the same vehicle, and not to mix in the same burning, some colours ground in turpentine and some ground in water. The pieces must also be very carefully dried, and must be placed in the furnace when this latter is moderately warm.

To Gild Glass.

Take of fine gold in grains, ...	1
Of pure mercury, ...	8

Warm the mercury, and then add the gold, previously making it red hot. When the gold is perfectly dissolved, pour the mixture into cold water, and wash it well. Then press out the superfluous mercury through linen, or soft leather, and the mercury which runs through (as it retains some gold) may be reserved for the next opportunity.

The amalgam which remains in the leather is to be digested in warm aqua-fortis, which will take up the mercury, but will leave the gold in the form of an extremely fine powder. This powder, when washed and dried, must be rubbed up with one-third of its weight of mercury, then mix one grain of this amalgam with three grains of gold flux, which is to be applied in the usual manner.

METHOD OF SEASONING MAHOGANY IN A FEW HOURS.

The importance of this method of seasoning mahogany in a few hours, which in general has not been done in less than a year, is great: in the first place, a considerable part of the capital which is invested in wood lying to season during many months may be saved: in the second place, as none of the small stuff, from two to six inches thick, is ever seasoned, according to the usual course of trade, all articles made of such wood, such as chairs, ballustrades, &c., must necessarily be excessively subject to warp, which is prevented by adopting this expeditious mode of seasoning.

Having provided a steam-tight wooden box capable of holding conveniently such pieces of mahogany as are fit for chairs, &c. a pipe from a boiler is adapted to it, by means of which, after the mahogany has been put in, the box is filled with steam, the temperature of which is about equal to that of boiling water.

The time required for inch-and-half wood is about two hours, and pieces of this thickness will become sufficiently dry to work after being placed in a warm room or workshop 24 hours. The wood by this treatment is somewhat improved in its general colour, and those blemishes which are technically called green veins, are entirely removed. It is also obvious, that the eggs or larvæ of any insects which may be contained in the wood will be destroyed by the heat.

PRIZE FOR THE MANUFACTURE OF ARTIFICIAL ULTRAMARINE.

Ultramarine has always been regarded, both from the brilliancy and depth of its colour, as one of the most valuable preparations in many branches of the arts. The highness of its price forms, however, an insuperable objection to its universal introduction: there appears, however, a great probability that an ultramarine may be manufactured, having all the qualities of that produced from lapis lazuli, by a preparation of substances of very inferior value.

It was originally believed that the colour of lapis lazuli was owing to an oxide of iron contained in that stone; but Messrs. Clement and Desormes, having being enabled to operate upon large quantities of lazulite, have succeeded in extracting from it an ultramarine entirely free from iron. These analyses have demonstrated that if the sulphate of iron is always found in the lazulite, it has no influence in the production of the blue colour.

When the analysis of Messrs. Clement and Desormes was published, it was not imagined that soda and potash would be classed amongst the metallic oxides. When, however, the experiments of Sir H. Davy had effected this, it began to be suspected that the large quantity of soda found in ultramarine, must be the true cause of its colour; and this opinion was confirmed by the circumstance of these metals taking, in the first degree of oxidation, a blue colour. Since this period many attempts have been made to substitute soda for potash in the production of a perfectly colourless glass; and it was found that the greater the degree of purity possessed by the soda, the more did the glass receive a blue tint.

From these facts it has been imagined, that it would be possible to manufacture an ultramarine at a price so moderate as to allow it to be used not only in works of art, but also in those operations where cobalt and Prussian blue are generally employed.

A prize has been proposed by the Sociétié d'encouragement d'Industrie Nationelle, in order to effect this object. It offers six thousand francs for the discovery of a process for producing economically, an ultramarine, similar in all respects to that extracted from the lazulite. The society will regard a process as economical by which a kilogramme of this colour may be manufactured at an expense of, at the most, three thousand francs, persuaded that ulterior improvements will considerably diminish the cost of production.

RESEMBLANCE BETWEEN THE FOOT OF THE WALRUS AND THE FLY.

Sir Everard Home, in the course of his investigations on comparative anatomy, has observed a very singular resemblance between the foot of the walrus and the fly. It is certainly not a little curious that two animals, so different in size, should have feet so similar in their use. In the fly the parts require being magnified one hundred times to render this structure distinctly visible; and in the walrus the parts are so large as to require being reduced four diameters to bring them within the size of a quarto page. A knowledge of the structure of the fly's foot led to the detection of the use of the hind flipper of the walrus; and an examination of the toes of the walrus enabled Sir Everard to make out the use of the two points, a part of the foot of the fly he did not previously sufficiently understand. Mr. Adams called these points pickers, from supposing that they entered certain small holes in the surface, on which progressive motion was carried on. This opinion Sir Everard did not deem worthy of consideration, but he was unable to make out their real use. On comparing them, however, with the outer toes of the walrus, they are evidently intended to surround the exhausted cavity, so that a vacuum may be more suddenly and perfectly formed.

As the skin of the animal is very thick and unyielding, and had been for a long time in strong brine, the parts of the one he examined were much shrunk and corrugated; but even in that state they showed that the palm of the flipper formed a concavity, which had the appearance of a cup when the great and little toe were made to encircle the others. In this state of the parts the concavity was thrown into longitudinal rugæ, so that the real size could not be ascertained, the span, from the point of the great toe to the end of the little toe, not exceeding twelve inches.

When the thick skin upon the palm was dissected off, the flipper lost all appearance of a foot, and took on that of the hand of a giant, so far as respected the bones and muscles, differing, indeed, in having a web covering all the other parts, and extending beyond the point of the thumb and fingers. The resemblance of the bones of the hind flipper of a walrus to those of the human hand is curiously exact; the bones of the wrist are the same in number and shape, so are those of the metacarpus: so also the phalangis of the thumb and fingers.

That this gigantic hand is employed as a cupping glass to prevent the animal from falling back in its movements, either on the ice, or in climbing the rocky cliffs, there can be no doubt; for it is only necessary to take the human hand, and envelope it in an elastic web extending some way beyond the points of the fingers, to prove that it could perform such an office; but when we see that the lumbricales muscles are wanting, the only use of which is to clench the fist, it adds to the proof.

It may be doubted whether the extent of the flippers is equal to the support of the enormous bulk of this animal; but this doubt will be removed when it is mentioned that, on the information of Mr. Fisher, a walrus killed at Spitzbergen, weighed twenty hundred-weight, and that an exhausted surface of 28 inches by 20 will support a pressure of 15 lbs. on every square inch—more than double the weight of the animal. That the principle on which the foot of the fly, the gecko, and the walrus is formed are the same, seems to be indisputable. The foot of the fly, however, has two cups, that of the walrus only one.

THE INDIAN CEDAR.

In the mountainous regions of Nepal, Kashmeer, and Thibet, grows a species of cedar, which has been dignified with the appellation of "Devadara, or wood of the Gods;" the word *Deva* in the Sanscrita signifying God, the affinity of which to the appellation of the Supreme Being in the Greek and Latin, as well as Gaelic (*Dia*), is very striking. The *Devadara* is nearly related to the Cedar of Lebanon. It is the *Pinus Deodara* of Roxburgh, and is figured and described in the second volume of Mr. Lambert's monograph of the genus. A still more complete description and plate, however, of this interesting tree, will be given in the new edition of that magnificent work, now nearly ready for publication. The *Deodara* exceeds in size the Cedar of Lebanon, and far surpasses it in the quality of its timber. The wood is compact, light, easily worked, and capable of receiving a fine polish. It is so highly impregnated with turpentine, as to render it almost imperishable, whether from the effects of the weather or of insects. It is used throughout Kashmeer and Thibet, in the construction of temples and other public buildings, as well as for bridges and boats. The celebrated traveller, Mr. Moorcroft, informs us, in a manuscript journal lately deposited in the library of the India House, that, in buildings which had been erected several hundred years ago, when lately taken down, the rafters and beams of Deodar were so little impaired, as to be used in the construction of other buildings. The wood is likewise used for forming torches, and in place of candles in dwelling-houses, and burnt as incense in the temples. The *Pinus Deodara* forms, on the flanks of the mountains, extensive woods, generally mixed with other species of pine, and with various species of oak and birch. From the observations of Lieutenant Herbert, it would appear that the ultimate limit of the *Deodara* extends even beyond 13,000 feet above the level of the sea, which would make it perfectly hardy in our own country.—Several young plants have already been raised both in England and Scotland; but two of the finest specimens I have seen, are in the arboretum at Hopetoun House, the seat of the Earl of Hopetoun. They were raised in the year 1818 by Mr. Smith, his Lordship's intelligent gardener, from seeds communicated by Dr. Govan, late of Saharunpore, a gentleman who has attended much to the botany of the North of India. The largest of the specimens at Hopetoun House, Mr. Smith informs us, is 3 feet 9 inches high, and has produced a shoot this season 16 inches long. During two winters, Mr. Smith kept them sheltered by a mat from the north winds.

CURIOUS FACT IN THE NATURAL HISTORY OF BIRDS.

Should any fatal accident befal either a male or female bird after two of them have paired together, the survivor loses little time in unavailing sorrow, nor is any great nicety shown in forming a new connexion, as the following little history will evince:—A pair of magpies began to build their nest in a gentleman's garden at Burbage in Wiltshire. Disliking their familiarity, he shot one of them from an ambush made for the purpose. The next day there were again a pair going on with the work. One of these was also shot. The loss was not long in being repaired, for the day following the pair were again complete, when another fell a victim to the gun. Thus the gentleman went on destroying one of them daily, until he had killed seven; but all to no purpose—the remaining magpie soon found another mate. The nest was finished, and young ones were produced, which were suffered to fly. This is an extraordinary fact. It seems to show that nature has a reserve of birds in an unconnected state, immediately ready to repair losses. Were the whole to pair at once, the circumjacent country might be insufficient to furnish food for the immense number of young ones that must burst forth at the same time.

ON THE BRAIN OF INSECTS.

Among the insect tribe, the brain of the humble bee stands first, as being largest in proportion to the size of the body of the insect. Swammerdam has given a representation of the bee, which is in general correct, but not so in respect to the optic nerves. The brain of this insect is of a truncated oval form; it gives off the nerves to the eyes and feelers; its internal structure is made up of globules. The substance, corresponding in its uses to the medulla spinalis, is nodulated on its external surface, connected to the brain by two long cords, which differ from nerves in collapsing soon after being exposed. The lower position of this nodulated structure corresponds to the medulla spinalis, and in its internal structure resembles the brain. The two nerves that go down, connected at certain distances by small nodules, are different from nerves in being more pulpy, and the nodules themselves are composed of congeries of nerves similar to the ganglions in the human body. The moth and caterpillar have the same kind of brain, medulla spinalis, and series of ganglions, as the bee: the parts in the caterpillar are nearly of the same size as in the moth, but in both they are smaller than in the bee. Swammerdam has given a correct representation of these parts in the caterpillar of the silk-worm, but none of the moth. The lobster is similar in the structure of all these parts to the bee, although they are smaller in proportion to the size of the animal. The earth-worm has a brain and nerves, upon a smaller scale, but made up of the same parts. In the garden-snail, the brain and medulla spinalis are, upon the whole, larger in proportion to the size of the animal than in the bee; but in this animal there are no ganglions, which may account for these parts being so large.

DUNBAR MECHANICS' INSTITUTION.

We have already had occasion to take repeated notice of this Institution; and certainly of none have we done so with more pleasure. There appears to be so strong an interest taken in its welfare by the mechanics themselves, and so much encouragement given to it by its wealthier patrons, that it is always gratifying for us to hear of it, as we have in general some interesting matter to impart. What took place at the first meeting of this Institution, which was held after new-year's-day, reflects so much honour on the Magistrates of Dunbar, as well as on the mechanics themselves, that we think it should be generally known: we should be glad to hear if it were generally imitated.

The mechanics of Dunbar attending the Institution, sensible of the benefits they have received, and are likely still to receive from it, had agreed amongst themselves, most readily and unanimously, to subscribe for and present, as a new-year's gift to the Institution, a pair of globes. A very full meeting of the members was held within the Mason's Hall, Dunbar, on the evening of Wednesday the 4th of January, when the globes were presented to the Institution. The following letter, from Mr. John Sked, operative manager of the Dunbar Foundry, was read upon this occasion, which, as showing the spirit with which the subscription was raised, we insert;—

"Dunbar Foundry, 4th Jan. 1826.

"Dear Sir,—I am very sorry that it is not in my power to attend to-night, but John Dickenson and William Balsellie have promised to officiate for me. The globes will be carried into the Hall by apprentices, George Samson and Peter Dawson. I have to direct the attention of my brother workmen to the inscription engraved on the brazen meridian of each globe. Thomas Cockburn, as well as I, can bear ample testimony to the zeal displayed on this occasion; and had the price been twelve in place of six guineas, it would have been just as readily and as cheerfully raised. Mr. Morton, our *Lecturer* and *friend*, whose delight is to remove all our difficulties or render them pleasant, will soon make us acquainted with the globes.

"I am, Sir, yours very truly,
(Signed) "John Sked.

"*To the Secretary of*
The Mechanics' Institution."

The globes, bearing the following inscription, "Presented to the Dunbar Mechanics' Institution, by the Mechanics in connection with it, in 1st session, 1825-26," were then brought in by two apprentices, and received by Mr. Morton, the Lecturer and Vice-President of the Institution, who then addressed the meeting as follows:—

"Gentlemen,—During the last three months, I have often had the pleasure of addressing you—of turning your attention upon philosophical subjects of the greatest importance—and of endeavouring to illustrate these subjects by lecture and experiment. No subject is more calculated to elevate, to expand, and to ameliorate the soul of man, than astronomy; no subject can be considered of greater importance than mechanics; and these have formed a portion of our pleasant labours. Mechanics is one of those branches of knowledge which contribute to distinguish civilized from barbarous nations. From it, works of art derive much of their beauty, and almost all their value; without it, we can make very little progress in the knowledge of the works of nature; and by it, we are enabled to improve every power and force in nature, rendering the motions of the elements, water, air, and fire subservient to the purposes and economy of life. All persons, then, are indebted to this science, from the king down to the humblest individual in the land.

"In treating of these different subjects in your hearing, I have enjoyed infinite pleasure from three different sources; first, with respect to myself; secondly, with respect to you; and, thirdly, from the advantages I anticipate may accrue from our meetings in this place.—First, then, with respect to myself. Having, from my youth, a most ardent thirst after literature and science of every kind, particularly mathematics and natural philosophy, I have spared neither time, labour, nor expense to obtain the little knowledge I now possess of these sciences; and, as I have this ardent thirst for knowledge myself, I am no less anxious to communicate what I know to others. To instruct mankind has, and I hope as long as I live shall, always be my chief study and delight. In the second place, with respect to you; never I am sure had any lecturer a more attentive audience; from the adult down to the youngest individual in this society, all conduct themselves with a degree of decorum and attention highly honourable to the society—useful to themselves—and gratifying to me; so much so, indeed, that when the time is elapsed when the lecture must end, I could with pleasure begin again or lengthen out the subject, if that could be attended with any advantage. My third source of pleasure arises from anticipating the happy result attending my present labours. Let the Dunbar mechanic go on as he has done for the last three months to study mathematics and algebra—attend lectures on philosophy—spend his leisure hours in the reading-room, where is to be found an extensive and well selected library—ponder much on the subjects of which he reads and hears—and in a few years there will be no class of mehanics in the kingdom more intelligent. He will not then have simply a smattering of knowledge in these subjects, but he will be able to talk learnedly upon them and turn them to his own advantage in his daily occupation, whatever that may be.

"At no time have I ever addressed you with greater pleasure than I at present do; and with no instruments or apparatus have I ever presented you, (or ever will present you for illustrating the different subjects of my lectures, and much I have shown, and much more will yet be shown,) with greater pleasure than I now do the instruments now before me—these two globes. No inscription that I have read for many years have I read with more lively feelings, than I read you the inscription engraved round their brazen meridians. Let the man already arrived at maturity, from the bottom of his heart, applaud this meritorious act. Let the youth, for whose use they are intended, hail with joy this suitable present; and let us all, with one heart and one soul, bless the Giver of every good and perfect gift, that we live in a land of light and liberty, under a gracious sovereign, and a mild government, where we are allowed the happy privilege of thus assembling ourselves for mutual and mental improvement. Let bigotry, superstition, and a dastardly spirit which would keep mankind in ignorance, be ashamed and hide their odious heads; and may religion and science overcome all such opposition.

"Gentlemen,—This handsome and suitable present is just the thing wanted for this society; for the study of the globes is of the utmost importance to youth, and should be taught ere half the school authors are read, as Milton strongly recommends. In name of the subscribers, then, who have purchased these globes, I give them over as a present to this society, and I give my most sincere wish along with theirs, that they may be thoroughly studied, and properly understood by the youth belonging to the society; that these youths may become an honour to themselves, a comfort to their parents, and a blessing to society, and wherever they go, and whatever occupation they follow, by their steady conduct and mental ability, they may always be an honour to the Dunbar Mechanics' Society. May your

Institution, now firmly established, long continue to flourish, a praise and an honour to yourselves, to the town of Dunbar, and to this small, but intelligent corner of East Lothian—already *mechanically classic* from being the native ground of Rennie, and of Nicholson, and the scene of Meikle's inventive achievements."

After this part of the business had been concluded, Mr. Wm. Robertson, the Secretary, presented and read the following letter from Major Middlemass, the Provost of the City—and we wish all Chief Magistrates would so write with regard to Mechanics' Institutions.

"Dunbar, 2d January, 1826.

"DEAR SIR,—The Magistrates and Council have learned, with much pleasure, that the mechanics' school has adopted a plan of *self-instruction*, which, taken in connection with the zealous exertions and able superintendence of Mr. Morton, can scarcely fail rapidly to disseminate information and useful knowledge amongst the working classes in this town and neighbourhood.

"The progress making by Mr. Morton's pupils is, we are assured, highly gratifying; and, as that Gentleman has already furnished himself, at a great expense, with very valuable mathematical and philosophical apparatus, for his own particular and ingenious experiments, the Magistrates and Council desire me to offer, for the accommodation and practice of his pupils of the Institution, in their private hours, the care and use of those instruments belonging to the town, formerly under the guidance of their worthy teacher, Mr. Coltman, now retired. The Magistrates and Council have no doubt, that under the immediate inspection of the Committee of Management, every care will be taken of the instruments; and, while they hope that the original promoters of the Institution will still continue their friendly and judicious assistance, they sincerely wish that the laudable endeavours of the *mechanics themselves* may be crowned with that success which they so justly merit.

"The different articles of mechanism will be delivered by inventory to any person the Institution may appoint to receive them.

"I am, DEAR SIR, yours truly,
(Signed) "C. MIDDLEMASS, Prov.
"*Mr. Robert Watson, Westbarns.*"

Mr. Robertson then stated, that after the obligations already conferred by Provost Middlemass, not only as a liberal contributor, but in having granted the Institution the use of two convenient and commodious rooms for their library and classes, he hardly knew what to say in return for this last, most valuable, and most important favour. Upon the motion, however, of Mr. Robert Brown, clothier, the grateful and respectful thanks of the Institution were unanimously voted to be presented to the Provost and Magistrates, along with perpetual tickets of admission to the Lectures, for the distinguished mark of their kind regard. A copy of Major Middlemass' letter was ordered to be entered on the records of the Institution, and the original to be carefully preserved. A Committee was appointed to receive and take the charge of the apparatus thus lent to the Institution.

Upon the motion of Mr. David Blair, clothier, the thanks of the Institution, along with a perpetual ticket of admission, were unanimously voted to Mr. William Balsellie, of the Edinburgh School of Arts, (whom we on a former occasion mentioned as having undertaken the instruction of a junior mathematical class,) now about to leave Dunbar, who had first set the example of self-instruction in the Institution. Mr. Balsellie being present, they were presented to him by Mr. Watson, who on an after occasion presented and read the following letter from him:—

"Dunbar, 5th January, 1826.

"SIRS,—It was with feelings of the deepest gratitude and respect that I received the high though unmerited honour you last night conferred upon me, in presenting me your thanks, along with a perpetual ticket to your Institution. I hope you will excuse me for not expressing what I felt at the time, as I must confess my great inability in speaking at any time—but more especially in so respectable an assembly, and under such unexpected circumstances. I regret much leaving Dunbar, on account of the Institution—but you will learn, with pleasure, that William Galbraith has taken charge of my class. You shall always have my warmest wishes for your welfare—and may the establishment of the Dunbar Mechanics' Institution be the beginning of an era when knowledge shall flow down your streets like a stream, and be the means of bettering the moral and spiritual condition of society at large. Such, I assure you, Sirs, is the earnest desire of your obliged humble servant,

(Signed) "WM. BALSELLIE.

"*To the Members of the Dunbar Mechanics' Institution.*"

The Secretary afterwards read a long list of gifts and donations to the Institution, which we would gladly particularise had we room.

In our former notice, we mentioned that this Institution was in full operation all the six nights of the week; but Mr. Robertson the Secretary, and Mr. Brown, have added Sunday night to the others. This night is devoted to the reading of treatises connected with religion, such as Dr. Chalmers' Astronomical Sermons, and other works which lead the mind to admire the goodness of God in the creation. It has been proposed that an *Agricultural* Library should be added to the Mechanics' Library; and we shall be very glad to understand that this proposal is put in execution. We see no reason why the farmers in that Agricultural district should not have an opportunity of obtaining books connected with their profession, as well as mechanics. This part of East Lothian may well set the example of commencing such a Library—seeing that it has the honour of being the birth-place, and long the place of residence of Mr. Robert Brown, Tenant in Markle, whose system of Agriculture in the Edinburgh Encyclopedia, afterwards published separately, in 2 vols.—with his contributions while he conducted the Farmer's Magazine, entitle him to the first place among practical agriculturists and writers on agriculture.

Mrs. Hamilton Nisbet Ferguson, of Raith and Biel, and the other ladies of Dunbar, deserve great praise for the active interest they have taken in the Institution: we are sorry we cannot mention all their names.

We have devoted more space than some may think we should have done to our present notice of this Institution; but we think that the history of proceedings such as these, and the exhibition of sentiments such as those contained in the address and letters we have inserted, are the best answer to all those interested individuals who *will* see nothing but insubordination and idleness as the result of educating mechanics.

MISCELLANIES.

Adulteration of Iodine.—Iodine, although only lately introduced into the laboratory, has already been manufactured in a very adulterated state. By these means it has been sold at a low price, and considerable profits are supposed to have been realized by the manufacturers. It has, until lately, been by no means easy to adulterate iodine, but it has been found that mineral charcoal can be mixed with it. The test for detecting this imposition is alcohol, which dissolves the iodine without having any effect upon the foreign ingredient.

To obtain the proposed result, ten *grains* of iodine are treated with boiling alcohol at 36° *cent.* The liquid is poured off, and the operation repeated; the liquid should then have entirely dissolved the iodine if pure: if the solution is not complete, the iodine is not in a state of purity; having collected the residuum upon a filter, and washed it with distilled water, it may be recognized by the usual methods of treatment.

Glazing Earthenware.—M. Rochinski, a manufacturer of earthenware at Berlin, has found a varnish or glazing for common pottery, which, after trials made in the presence of the College of Medicine, offers no danger in regard to health, and resists the action of acids. This glazing is composed of five parts of litharge, two parts of well purified clay, and one part of sulphur. These substances are pulverised, and mixed with a sufficient quantity of caustic alkaline lie (soap-makers' liquor), so as to form a mixture fit to be readily applied on the earthenware, and to cover it equally all over. Carefully baked, these wares offer no trace of lead.

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THE GLASGOW
MECHANICS' MAGAZINE,
CONDUCTED BY
A Committee of Civil Engineers and Practical Mechanics.

> " Only let men awake, and fix their eyes, one while on the nature of things, another while on the application of them to the use and service of mankind."

No. CXIII. *Saturday*, 18*th February*, 1826. Price 3*d*.

MR. PERKINS' MODE OF DRAWING OFF BACK-WATER FROM WATER-WHEELS.

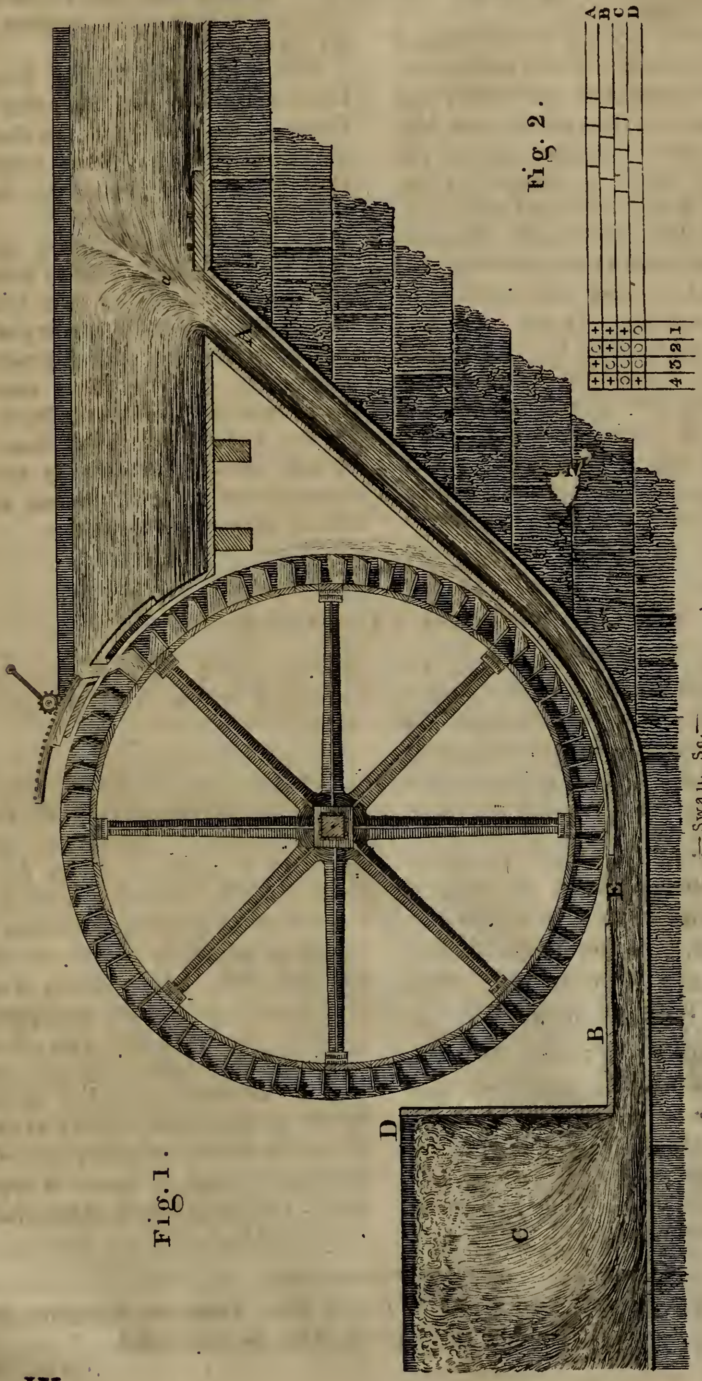

Fig. 2.

Fig. 1.

Vol. IV.

MR. PERKINS' MODE OF DRAWING OFF THE BACK-WATER FROM WATER-WHEELS.

THIS improvement in mills is that of using part of the superabundant water in times of floods or freshets, to free the water-wheels from the back-water occasioned by such freshets. To effect this purpose, the following plan has been successfully adopted. Fig. 1 of the plate is a view of a section of a water-wheel, and the system of forcing off the back-water which accumulates in time of floods. A represents a water-tight tube or trunk, being the breadth of the wheel and the depth of the buckets, running from the bottom of the penstock to or past the centre of the bottom of the wheel. B is a receiving-tube or trunk, being one-third larger than the small end of the tube, A, and is also in a direct line with it. E is an opening between the tubes, A and B; at this opening the back-water (which had accumulated under the wheel while the current was cut off by the gate, *a*,) is carried off by the lateral velocity of the current which rushes from the tubes, A and B. C represents the back-water; D, the bulkhead. It will be readily seen that by opening the gate, *a*, the water will rush down the tube, A, and join the back-water at E, and with it pass off through the tube, B, under the bulkhead, D. The water expended in turning the water-wheel will also be carried off by the same current through the tube, B.

ON WEAVING TWO OR MORE WEBS IN ONE LOOM.

GENTLEMEN,—In No. CVII. of your Magazine, I observe a plan for saving room in steam-loom factories, and doubling the quantity of work produced. I believe, however, that Mr. Alchorne's plan will not at all answer the purpose intended. The great object is to adopt such a plan as will be perfectly practicable, and, at the same time, not more difficult to superintend than that which it is intended to supersede. In his plan, although one *loom* only is required, where two were before necessary, the mounting and other parts of it are altogether doubled, so that *space* only is gained by his alterations. Many other difficulties occur in this plan which it is needless to point out, as they are at once evident to those acquainted with weaving. A much more useful, and, in my humble opinion, a much more practicable plan was proposed by me in a contemporary publication, some time ago, by which not only one loom is made to serve in place of two, but in which none of the other parts of it are doubled except the heddles and the treddles.

This plan is simply an application of the double cloth principle, whereby two, three, or more webs can be wrought in the same loom at the same time—to be afterwards cut up as those which are wrought two in the breadth: and it is not merely in steam-loom factories that this is applicable, but it can be usefully applied to a variety of the fabrics wrought in the hand-loom. In fact, when adopted in hand-weaving, it will be of more benefit to the operative than in the other case; because he will be able to produce nearly *double* the quantity of work that he produces at present, and as hand-wrought goods are now allowed to be very superior to those wrought by steam, the operatives may be able to bring back a part of that employment of which they have been deprived by the introduction of steam-looms.

In describing the plan referred to, I shall consider the web to be wrought as a 10^{00}; to make this two breadths, or two webs in one loom, 2000 heddles, cast on four leaves, will be required. *Twice* the quantity of warp required for one 10^{00} is to be warped, and beamed on *one* roll, and the yarn drawn through the heddles in what is called the straight-over draught, *i.e.* the first thread on the back leaf, the second on the next, the third on the next, and the fourth on the front leaf; this being done, the web is to be taken through a 10^{00} reed, *four threads in each split*, or, what is better, through a 20^{00} reed, *two threads* in the split.

The next step is the cording, which will be easily understood by referring to fig. 2 of the plate. In this plan the heddles are represented by the spaces A, B, C, D, and the threads drawn upon them in regular succession. 1, 2, 3, 4, represent the treddles, *o* the raising cords, and + the sinking cords; and a slight examination of it will make the whole matter perfectly plain. The treddles are marked in the order in which they require to be treaded, but the weaver will, of course, change their position in order to suit himself in changing his feet.

G. G.

Calton, 2d Feb. 1826.

ON THE VARIETIES OF THE HUMAN RACE.

LINNÆUS, in his "Sytema Naturæ," divided man into four varieties, according to the colour of the skin, giving each variety the name of the part of the world where it was most common. Dumerille considers that there are six distinct varieties, which he names, 1, Caucasian or European Arabs; 2, Hyperborean; 3, Mongolian; 4, American; 5, Malay; 6, Ethiopian. Cuvier reduced the number of varieties to three. Virey in his History of Man, divided the genus into two species, according to the facial angle, noting three varieties and subvarieties to each species. Desmoulins has lately further divided the genus man into eleven species; and Bury Saint Vincent, in a very elaborate paper on the varieties and species of this genus, has added four other species to this extended list, and has given the peculiarities, habits, manners, and appearances of each of the species, and an account of their probable origin. He divided the genus into two sections: the first he called Lewtrichi, or smooth-haired men, which he again subdivides into those which are peculiar to the old world; as, 1, Homo Japeticus, the sons of Noah, which he divided into several races; 2, Homo Arabicus, the Arabs; 3, Homo Indicus, the Hindoos; 4, Homo Scythicus, the Scythians; 5, Homo Sinicus, the Chinese. Secondly, those smooth-haired men, which are common to the old and new world; as, 6, Homo Hyperboreus, the Laplanders; 7, Homo Neptunianus, the Malays and New-Zealanders; 8, Homo Australasicus, the New-Hollanders. Thirdly, the straight-haired men, which are peculiar to the new world; as, 9, Homo Colombicus, the Caraibes; 10, Homo Americanus, the Americans; and 11, Homo Patagonicus. The second section he designates by the name Outetriche, or crisp-haired men, which are usually called negroes. The white varieties of this tribe are not known. 12, Homo Ethiopicus, the Ethiopians; 13, Homo Cafer, the Cafre; 14, Homo Melaninus, the Colchin Chinese; and 15, Homo Hottentotus, the Hottentots.

IMPROVED GLAZE FOR PORCELAIN.

The common glaze for porcelain and the finer kinds of earthenware, contains a considerable proportion of glass of lead; this ingredient, however, on account of its being mixed with a certain proportion of silicious earth, and other vitrifiable materials, unites with them into a glass, which, although easily fusible, is not in the least acted on by any articles of food. It is not, therefore, from the apprehension of any injury to the health of those who use vessels of porcelain, that the use of lead in the glaze is objectionable, but because it is extremely liable to combine with, and degrade the more delicate colours, especially those given by preparations of chrome and of gold. This is particularly the case in the more expensive and elaborate products, which, on account of the multiplicity of their colours, require to be repeatedly heated, or fired. In the following receipt for glazing, the above-mentioned defects are avoided. The principal ingredient is felspar, of a somewhat compact texture, and a pale flesh-red colour, which forms veins in a slaty rock adjoining to the town of Welsh Pool in Montgomeryshire. This material being free from all adhering pieces of slate and of quartz, is ground to a fine powder, and being thus prepared, is mixed as follows, *viz.* 27 parts felspar, 18 of borax, 4 of Lynn sand, 3 of nitre, 3 of soda, and 3 of Cornwall china clay.—This mixture is melted to a frit, and is then to be ground to a fine powder, 3 parts of calcined borax being added previously to the grinding.

ESSAYS ON BLEACHING,

By James Rennie, A. M. Lecturer on Philosophy, &c. &c., London.

No. IV.—CHEMICAL AND PHYSICAL NATURE OF STUFFS.

No satisfactory account can ever be given of a chemical process, unless all the substances which are employed in it be minutely known, both as to their general nature, and, if possible, as to their composition when they are compounded.* This has not been properly attended to in any of the works on bleaching which have fallen into my hands, as none of them give any chemical account of the substances which are to be operated upon. This deficiency I shall attempt to supply, although I feel that my information is inadequate to do it justice, and it would require more laborious analytical and experimental research than either my ability or leisure will allow, in order to render it more perfect. I have derived the best part of the knowledge I have of this subject from Home, Fourcroy, Kirwan, and Bancroft.

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* We would not, however, be understood to infer from this that a knowledge of the structure and composition of the ultimate constituents of the substances in question will much assist us in anticipating, without previous trial, the result of any process in bleaching; we merely infer that such knowledge may assist us to explain upon what the effects produced depend, and may suggest material improvements both in efficiency and economy.

Animal substances differ very much from vegetable, both in their physical structure and chemical composition. Wool and silk, for example, are much looser in their texture and have less adhesion between their constituent parts than cotton and linen, and are therefore more disposed to combine with other matters which are brought into contact with them, and manifest stronger affinities for the ordinary agents of bleaching.* Their chemical composition is still more dissimilar from that of vegetables, in containing a greater proportion of hydrogen, and particularly of nitrogen, which, in vegetables, is usually present in but small quantity. It is the tendency of these to assume the gaseous form which renders the adhesion of the ultimate principles in silk and wool so slight and easily overcome. When they are subjected to distillation, these two principles seem to unite and form with oxygen the volatile alkali, which is seldom developed in any quantity from vegetables by the retort, the several acids being the ordinary product of the still. It is this that renders animal substances more liable to the putrefactive fermentation, and vegetables to the vinous and acetous. Wool and silk yield more oil than most vegetables; cotton, indeed, contains very little, and linen not much more, although the seed of flax affords it in abundance. This accounts for the brighter flame of animal substances during combustion, when also the presence of ammonia is distinctly perceived from the pungent smell which, in that case, is emitted. Silk and wool are much more easily decomposed than linen and cotton, from the enlarged sphere of affinity which their more numerous constituents produce. It is on this account that the sulphuric, nitric, and muriatic acids decompose and weaken the texture of silk and wool, while vegetables are but slightly affected by acids of the same strength. The nitric acid acts on the former by extricating their nitrogen, separating the fatty matter, and forming carbonic and oxalic acids. The sulphuric extricates their hydrogen, a small portion of their nitrogen, and leaves a carbonaceous residuum. The alkalies, again, destroy animal substances by combining with their oils, which sheath their causticity and form soap, while they affect vegetables but slightly. Silk is the least liable of all animal substances to be acted upon by acids or alkalies, as it is more nearly allied than wool to vegetables in its structure and composition. But I shall give a more specific description of those differences, beginning with the animal substances.

1. *Silk.*—This substance is procured from cocoons formed by the caterpillar of the *Bombyx mori* of Linnæus previous to its transformation into a moth. It consists of filaments of great tenuity and comparative strength, which are uniformly covered by a very thin pellicle of a glutinous or gummy

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* This is well illustrated by what takes place in dyeing of a scarlet colour the woollen cloth which is sometimes edged with cotton, as the cotton, being less easily affected, remains white after the wool has acquired the required shade; the same will happen if cloth be made with cotton warp and woollen woof, as has been experimentally shown by M. Dufay.—*Bancroft.*

matter, which serves to render them stiff and elastic. They are usually of a yellowish tinge, from the combination of colouring matter, which M. Baumé found to consist of a resin perfectly animalized, affording, by distillation, the same products as other animal matters, and the concrete volatile alkali, (see Journ. de Phys. 1793.) This it is necessary to remove, in order to render the fibre pliant and manageable for the manufacture of cloth, which is commonly done by means of soap, according to a process described by Berthollet. Besides this gummy and colouring matter, M. Roard (Ann. de Chim.) found that there is another substance, like wax, which requires to be removed. He informs us that the gum is commonly in the proportion of 24 per cent., the colouring matter about 55 or 60, and the wax seldom more than 1, and often only about half that proportion. The gummy substance is soluble in water, and would be easily managed if the others were not present, for it unfortunately happens that the colouring matter cannot be dissolved by water; it is, however, soluble in alcohol, and also, together with the animal wax, capable of being removed by alkaline leys or by soap.* The silk procured from the cocoons of the Bombyx mori, seems to differ considerably in strength and composition, according to the different places in which the insects live; but my information is too scanty to be able to point out those differences with precision. In India and China, silk is procured from several other insects of the same tribe, which are more strikingly different from the common silk. Dr. Roxburgh (Lin. Trans.) tells us of a phalena whose cocoons are remarkably soft, and white, or yellowish, but it being difficult to wind off the silk, it is spun like cotton, and possesses durability almost incredible, the life of one person being seldom sufficient to wear out a garment of it. Its texture and composition must be very different from common silk, as it will not bear washing in hot water. The Doctor mentions another sort of silk which is coarse, durable, and dark coloured, and much worn by the Bramins. The silk from Nankin in China is naturally pure white; but the Chinese, according to M. Baumé, (Journ. de Phys. 1793,) bleach a great quantity of common silk and pass it for Nankin.

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* It was found by Mr. Mushat that silk contains more carbon than any of the other substances employed in the manufacture of cloth. He distilled, in the dry way, 200 grains of white silk stuff, and during the process there was a violent discharge of bituminous flame and smoke. The residuum was formed into a caked coal of a dense compact structure; cellular, though not in the least brittle. The colour was iron-gray, with a faint shade of copper. When struck, it was sonorous in a high degree. It weighed 62 grs. and had consequently lost by the process 138 grs. Silk, then, is composed of 69 grains volatile matter, and 31 of oxide of carbon. (Phil. Mag. xxxiii. 4.)

ON THE ORIGIN OF ERGOT.—By GENERAL MARTIN FIELD.

[From the American Journal of Science.]

As to the origin and nature of ergot, various opinions and theories have been adopted; but the three following have appeared the most plausible, and have been the most strenuously supported.

First, Among the French, Tissot and others affirm, "that ergot, or spurred rye, is such as suffers an irregular vegetation in the middle substance, between the grain and the leaf, producing an excrescence," and that this morbid change is produced by the extremes of humidity and heat of the season.

Second, In England it has been the opinion of some, "that ergot is an excrescence caused by the sting and deposition of the eggs of an insect."

And Third, Others affirm that it is a parasitic fungus, like the different sorts of blight, smut, &c.

I shall not attempt to support or oppose either of the opinions above-mentioned; but shall relate such facts as have fallen under my view, without regard to any theory upon the subject. The field of rye in which I made my observations, was within fifty yards of my house, which afforded me an opportunity of examining it daily for many weeks. It was of that species which, in this part of the country, is usually denominated the Norway, or White Rye, and which has ever been observed to be far more productive of ergot than the English spring rye, or that which is said to be a native of the island of Candia. But it is not recollected that during any former season, the ergot has been found so abundant in this vicinity as during the last.

The Norway rye is in blossom about as early in the season as the English spring rye; but it is two weeks later at harvest. From this circumstance, one reason may be assigned why the former is so much more productive of ergot than the latter. The longer the grain continues in the pulpy or milky state, the more favourable is the opportunity presented for the operation of the cause which produces ergot. That such is the fact, experience clearly demonstrates. The field of rye which I very frequently examined was in full blossom about the 30th of June; but I discovered no appearances of ergot till the 22d of July. From that time till the 12th of August, when the rye was harvested, it might be found of various dimensions. Upon minute examination, I discovered that every grain of ergot as it emerged from the glume, had attached to its apex the shrivelled rind of a grain of rye, which had the appearance of once being in a healthy state. This led me to conjecture that a diseased state of the rye was the primary cause of the ergot. To ascertain the fact, I repaired to the rye field, where I discovered groups of flies collected upon the heads of rye, apparently in pursuit of something within the glume. On opening the valve of the glume where the flies were thus collected, I found the saccharine juice of the rye was oozing out and would soon produce small drops. I was then convinced that it was this saccharine fluid which was so inviting to the multitude of flies that collected upon those heads of rye, which contained any diseased grains.—Having collected a number of grains of full grown size, and exhibiting appearances similar to those above-described, I placed the same under a microscope, by which I could clearly discover a small orifice in each, near the end opposite to that to which the thread of nutrition had been attached. I could also discover that the juice of the grain was still discharging from the orifice.

On the morning of the 1st of August, by observing the groups of flies, I found two heads of rye near each other, and each of which contained a grain of punctured or diseased rye. The culms I tied to a stake drove between them, the better to enable me again to find them, and to observe their future appearances. At that time the punctured grains exhibited no symptoms of decay, otherwise than a small discharge of fluid. During the first day the flies were busily employed in extracting their delicious beverage from the orifice of each grain, and when it did not flow in sufficient quantity for their supply, they would probe it anew. On the 2d of August both grains appeared to be in a state of fermentation, and rapidly tending to decay. On the 3d, being 48 hours from the time when I commenced my observations, each grain had become a rotten and shapeless mass, and exhibited very little appearance of healthy rye.

When on carefully opening the valves of the glume, I discovered in each a small black globule, the size of which was rather larger than a pin's head. These were situated at the points of the peduncles of the diseased grains, which afterwards proved to be ergot. During the first four days after the ergot was discovervd, they grew in length very near two lines in each 24 hours, displacing the remains of the deceased rye from the glumes which they had occupied. On the 12th of August, the ergot had attained its full growth. The dimension of one grain of ergot was 12 lines in length, and 3 lines in diameter.—The other grain measured a little less.

On the 3d of August, being convinced that the primary cause of ergot was the puncture of the healthy grain by the fly, it occurred to me that perhaps it might be produced by such means as I possessed. To ascertain this fact, with the point of a fine needle I punctured four grains of rye in the same head, it then being in a green pulpy state, and of full grown size. A discharge of the juice of the grains was soon discovered from the orifice of each. The flies collected as in those cases before-mentioned. The result was, that on the fourth day after the operation was performed, ergot appeared in the glume, occupying the place of two of the punctured grains. The other two grains exhibited no symptoms of decay, but continued in a healthy state. From appearances, I am led to believe that in warm dry weather many of the grains of rye are punctured which are not materially injured thereby. The orifice closes before a sufficient quantity of juice has escaped to produce fermentation and decay. This may, therefore, be assigned as one reason why cloudy and wet seasons are so much more productive of ergot than those which are fair and dry.

Under a good microscope, I occasionally examined the ergot, and also the grains of rye, in every stage of decay, but was never able to discover in either the eggs or larvæ of any insect. I therefore conclude that the puncture of the fly is for the purpose of extracting its food from the rye, and not for the deposition of its eggs.

The fly is of the hairy or bristly species of musca, and also a species of the "blow-fly." It deposits its eggs upon animal flesh, either fresh or putrid. Its wings are transparent, abdomen dark green, larger than the common house fly; in this climate in the months of July, August, and September, the most numerous species of the fly are very annoying to houses, men, and other animals.

The above statement contains all the material facts which have fallen under my view, in relation to the cause of ergot; and how far they go to support or oppose either of the theories heretofore adopted upon the subject, I submit to the decision of others.

In concluding this article, perhaps it may not be improper to state some facts in relation to the effect which the ergot produces upon the health of the plant on which it grows. I was never able to discover that the culm of rye was in the least affected by the ergot; but I have observed that invariably where there were to the number of eight or ten grains of ergot, no healthy or sound rye could be found in the same head. In such cases it appears that all the nourishment which the culm affords is exhausted by the ergot, and the rye suffers a severe blight.

The size of the ergot is usually in proportion to the number of grains in the same head. For when we find but one grain in a rye head, it is generally from 10 to 14 lines in length, or 2 or 3 in diameter; but where there are from twenty-five to thirty grains, which is not unfrequent, their dimensions are proportionally less, being often not greater than sound rye.

ON IMPROVING OUR FISHERIES.

Gentlemen,—You have called the attention of your countrymen, and, I may say, of the civilized world, to many subjects, and pointed out many improvements in manufactures, trade, and commerce, of which all classes and orders of society reap the advantage. If you think that the following remarks would have a tendency to promote the same end, their insertion in your valuable miscellany is submitted to your pleasure.

Having, in the early part of my life, devoted a great portion of my time to the fishery, I have ever since felt a peculiar interest in marking every symptom of its progress or decline in our own country; and have observed, with deep regret, our national apathy and indifference to the improvement of this—one of the most important branches of industry and wealth, which the Author of nature in such liberal profusion has placed within the reach of our exertions. In our insatiable thirst after the riches and commodities of foreign lands, we seem to overlook the natural treasures of wealth and benefit with which our own country has been favoured; closing our eyes to our own interest, and to the fact that the Dutch fill almost every part in Continental Europe with herrings taken on our coasts, which they find a very profitable source of gain, whilst we in more favourable circumstances do not sufficiently supply our own markets. The consequence is, the best salted herrings are selling in Glasgow, as I am credibly informed, as high as *fivepence per pound;** which places that which might have been a plentiful and beneficial article to the families of the poor labourer and indigent tradesman, beyond the reach of their scanty wages, and obliges them to purchase such an inferior kind (being cheap) as ought neither to be caught nor eaten. Is Glasgow destined never to be better supplied with this useful article? and does its local situation warrant the supposition that its market shall never be supplied with fresh fish in a more expeditious and eligible way than by that caught twenty miles east from the Isle of May? If neither of these positions can be maintained, every sensible person will admit that the sooner some measures to remedy these evils (if such are practicable) are adopted, the better. To accomplish these desirable objects, it appears to me that the most plausible way would be to form a Joint Stock Company, whose object should be to improve the herring and other fishery on the west of Scotland; and I am persuaded, were such established, and conducted upon rational principles, that it would not only be productive of general advantage to the inhabitants of the west, but also yield a return to the subscribers in a few years, at least equal to any joint stock speculation that has yet been set on foot, and patronized in this marvellous age of adventure and enterprise: surely such a promising and laudable undertaking as this need only be proposed to the spirited and intelligent gentlemen of Glasgow and vicinity, in order to ensure a sufficiency of means to carry it into immediate operation; and as a farther encouragement, I beg leave to add, that I have conversed with many of the most experienced and best informed fishermen in the east, west, and north, (who are undoubtedly better qualified to judge on this subject than the fish-curers,) and find that nine-tenths of them agree with me in the opinion that a successful and advantageous fishery might be carried on in the west, were proper boats, well furnished with good nets, &c. and manned with skilful fishermen, employed, notwithstanding the small success that has attended it for the last twenty years, which ill success may be wholly attributed to the improper and inadequate means used by the fish-curers, as every person who understands herring fishery will allow. If you, Gentlemen, will please to publish these general observations, which are merely designed to bring this important subject to the consideration of the enlightened public, I shall afterwards, perhaps, send you a more circumstantial detail of what appears to me essential to its improvement.

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* We suspect our Correspondent is rather above the market here, but certainly not much.—*Eds.*

I am, yours, &c.

An Old Fisherman.

Newhaven,
16th January, 1826.

Specification *of a* Patent *granted to* William Johnston *of Totham, Essex, for Means of Evaporating Fluids; for Conveying Heat into Buildings, for Manufacturing, Horticultural, and Domestic purposes; for Heating Liquors in Distilling, Brewing, and Dyeing; and in making Salt and Sugar, with Reduced Expenditure of Fuel.*

The specification of this patent describes four methods of effecting the purposes of its title. In the drawing representing the first method, three pans are placed, one above the other, so that the bottom of the upper one forms the top of that in the middle, and the bottom of the middle one the top of that which is lowest. Flanches project from the top and bottom of the middle pan, and from the bottom of the upper pan, and top of the lower pan, which serve for fastening them together steam-tight, by screws and nuts. For the pans above the lower one, the bottoms may be formed by plates put in between the flanches, and made tight by the means mentioned.

These pans are to be furnished with tubes for conveying in and drawing off liquors, (which are not shown in the draught,) and for passing off the steam to other vessels, which latter tubes are to have valves, by which the pressure of the steam in the pans may be regulated by weights, and all of them are to have cocks, by which the communications can be opened or shut as required. The steam-pipes from the pans, in the draught, pass off sideways into one common tube, which enters a close vessel beneath an open pan, in which liquors may be boiled or evaporated by the waste steam of the others. The patentee states, that he has ascertained that a very large proportion of the steam at a high temperature may be thus conveyed off for useful purposes, after keeping up that of the pan from which it escapes to the degree of heat desired; and also that the heat of the lower pan, being raised above boiling point by loading its valve, for instance, till the liquor in it is raised to 240 deg. Fahrenheit, that in the pan above it may be brought to 230 deg., by the heat conveyed through its bottom from the former; and that in the upper pan to 214 deg., by the heat of that last mentioned. Of these pans the lower one is placed in a furnace, and exposed to the action of the fire in the usual method, and the upper ones receive their heat from it as described; and although only three pans are shown in the draught, placed as described, it may easily be conceived that a greater number may be arranged in a similar manner. In the second method, one large vessel, like the boiler of a steam engine, is placed on the fire-place or furnace, in which several other flat pans, with close tops, are arranged one over the other successively, but with small intervals between them, to let the steam from the outside vessel act on all parts of them. For the admission of these pans, one of the ends of the outside vessel is so fastened on by flanches and screws and nuts, that it may be taken out when required. All these pans have pipes passing into them and from them, through the outside vessel, for the same purposes as those mentioned in the first method, and are furnished in like manner with cocks and valves; and the steam may be similarly conveyed from them to operate on other detached vessels. The third method will be best described from the draught. In that, three vessels are shown, one over the other, the top of the lower one forming the bottom of that in the middle, as in the first plan; but the top of the middle one and the bottom of the upper one being distinct, so as to leave a small space between them for the admission of steam, which is conveyed into it from the lower vessel, on which the fire operates, by two pipes that pass up from the latter into it, along the sides of the middle vessel. From this middle vessel the steam goes off into the upper one by a pipe in its centre, which passes through the interval between them sufficiently high to rise above the liquor in the upper vessel; and from the top of this upper vessel another pipe conveys the steam from it where it is desired to operate. The fourth method seems to be a combination of the first and second. In it the lower pan, which is exposed to the fire, contains one or more close shallow vessels, managed in all respects as those in the second plan; above them it has a close top, which serves as a bottom to an upper vessel, as represented in the draught; from all these vessels steam-pipes pass into a detached close vessel, as in the first method, on which an open pan is fixed for evaporating or other uses, and tubes also pass into them for conveying liquors into and from them, all which pipes are furnished with cocks, and those for the steam with valves, in a similar manner to the method first described. In all the several methods the bottoms of the pans are to be sustained by ties, in the same manner as that used for the bottoms of steam-boilers, when they are large enough to require this precaution; room being left in them to put in and take out the keys by which the ties are connected.

CASE OF HALF BLINDNESS.

Upwards of twenty years ago, Dr. Wollaston was affected with a peculiar state of vision, or species of blindness, in consequence of violent exercise he had taken for two or three hours before. He suddenly found that he could see but half the face of a man whom he met; and it was the same with respect to every object he looked at. In attempting to read the name "Johnson," over a door, he saw only "   son;" the commencement of the name being wholly obliterated to his view. The loss of sight was towards the left eye, and was the same whether he looked with the right eye or the left. This blindness was not so complete as to amount to absolute blackness, but was a shaded darkness with definite outline. The complaint was of short duration, and in about a quarter of an hour might be said to be wholly gone, having receded with a gradual motion from the centre of vision obliquely upwards toward the left.

About two years ago a similar affection again occurred to him, without his being able to assign any cause whatever, or to connect it with any previous or subsequent indisposition. The blindness was first observed as before, in looking at the face of a person he met, whose left eye was to his sight obliterated. His blindness was, in this instance, the reverse of the former, being to his *right*, instead of the left of the spot to which his eyes were directed; so that he had no reason to suppose it in any manner connected with the former affection. On this occasion, the affection, after having lasted with little alteration for about twenty minutes, was removed suddenly and entirely by the excitement of agreeable news respecting the safe arrival of a friend from a very hazardous enterprise.

Dr. Wollaston has met with another instance of this within his own knowledge, in the case of ——— ———, who had suffered severe pain in his head for some days, about the left temple, and toward the back of the left eye; his vision became considerably impaired, attended with other symptoms indicating a slight compression of the brain. It was not till after the lapse of three or four weeks that the Doctor saw this person, and he then found that in addition to other affections, he laboured under a defect of sight similar to those which had happened to himself, but more extensive, and which has been unfortunately more permanent. In this case, the blindness was at that time, and still is, entire, with reference to all objects situated to the right of his centre of view. Fortunately, the field of his vision is sufficient for writing perfectly. He sees what he writes, and the pen with which he writes, but not the hand that moves the pen. This affection is, as far as can be observed, the same in both eyes, and consists in an insensibility of the retina on the left side of each eye.

ON THE THERMOMETRICAL STATE OF THE TERRESTRIAL GLOBE. By M. ARAGO.

[From the Almanac of the Board of Longitude of Paris for 1825.]

AN inquiry into the modifications of the different natures which the Earth has undergone in the course of ages, is one of the most curious questions in natural philosophy. We propose giving, in another place, an analysis of the works recently published by geometricians, on the subject of those modifications which concern the temperature of the globe, considered *in a general sense.* I shall confine myself in this article to examining, whether the opinion, rather generally admitted, that under all latitudes, the climate at the surface of the earth has undergone a deterioration, rests upon any solid foundation.

The invention of thermometers can scarcely be said to date farther back than the year 1590; and we may even add, that before 1700 these instruments were neither exact, nor capable of being compared with each other. It is, therefore, impossible to determine with precision what the temperature of any place on the earth may have been at a very remote period. But if we are satisfied to convince ourselves within certain limits —to confine ourselves, for instance, to the inquiry, whether the winters are in the present day more or less severe than they were formerly, we may supply the want of direct observations, by referring to those passages in different authors relative to several natural phenomena, such as the congelation of rivers, of lakes, of seas, &c. The few citations of this nature which are here collected, will, in my opinion, serve to prove, even allowing for the exaggeration so natural to ancient historians, that in Europe in general, and in France in particular, the winters were, some centuries ago, at least as severe as in the present day:

1st Century before our Æra.—At the mouth of the Palus-Mœotis, it had frozen so hard, that, in winter, one of Mithridates' generals defeated the cavalry of the Barbarians, precisely on the spot were they had been defeated in summer in a naval engagement. (Strabo, liv. ii.)

400 Years after J. C.—The Black Sea was entirely frozen. The Rhone was frozen entirely across! (This last phenomenon is the proof of a temperature of at least 18° centigrade below 0.)

462. The army under the command of Theodomer crossed the Danube on the ice. The Var was also frozen across. (It is ascertained that the Var becomes frozen when the temperature is from 10° to 12° centigrade below 0.)

763. The Black Sea and the Strait of the Dardanelles were frozen.

822. Carts heavily laden crossed the Danube, the Elbe, and the Seine on the ice during more than a month. The Rhone, the Po, the Adriatic Sea*, and several ports of the Mediterranean were frozen (—at least 20° at Venice.)

829. The year that the Patriarch of Antioch, Dionysius of Telmar, went with the Caliph Mamoun into Egypt, they found the Nile frozen. (Abd-Allatif, translated by M. Silvistre de Sacy, page 505.)

860. The Adriatic Sea and the Rhone are frozen (—20°.) Calvisius, quoted by Delisle.

1133. The Po was frozen across from Cremona to the Sea; the Rhone was crossed upon the ice; wine froze in the cellars (—18° at least.)

1216. The Po and the Rhone were frozen to a great depth (— 18° at least.)

1234. The Po and the Rhone were again frozen; loaded carts crossed the

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* When the Gulph of Venice was frozen in 1709, the thermometer had fallen in the city to —20° centrigrade. (Acad. 1749, Hist. 2.)

Adriatic on the ice in front of the city of Venice (—20°.)

1236. The Danube remained frozen to its greatest depth for a considerable time.

1292. Loaded carriages crossed the Rhine on the ice in front of Breysach. The Categat was also frozen entirely across.

1302. The Rhone was frozen across (—18°.)

1305. The Rhone and all the small rivers in France were frozen. (Papon, Hist. Provence, 3d vol. p. 102.)

1323. The Rhone was frozen across. Horse and foot travellers went from Denmark to Lubeck and Dantzic on the ice.

1334. All the great rivers of Italy and of Provence were frozen across (—18°.)

1358. Ten fathoms deep of snow at Bologna in Italy. (Matthieu Villani, cited by Papon, iii. 200.)

1364. The Rhone was frozen at Arles to a considerable depth; loaded carts crossed the river on the ice, —18° centigrade. (Villani, quoted by Papon, iii. 210.)

1408. The Danube was frozen across through all its course. The ice extended without interruption from Norway to Denmark. Carriages crossed the Seine on the ice. (Felibien, description of Paris.)

1434. The frost commenced at Paris on the last day of December 1433, and lasted for three months, less nine days; it recommenced about the end of March, and lasted until the 17th of April. This same year snow fell in Holland during forty days in succession. (Van-Swinden.)

1460. The Danube remained frozen during two months. The Rhone was also frozen (—18°.)

1468. In Flanders the soldiers' rations of wine were cut with a hatchet. (Philippe de Comines.)

1493. The harbour of Genoa was frozen the 25th and 26th December. (Papon, iv. 18.)

1507. The port of Marseilles was entirely frozen. (This proves a cold of at least —18° centigrade.) On Twelfth-day three feet of snow fell in the same city.

1544. In France they were obliged to cut the wine with sharped-edged instruments. (Mezerai.)

1565. The Rhone was frozen entirely across at Arles (—18° centigrade.)

1568. On the 11th December loaded carts crossed the Rhone on the ice. It did not break up until the 21st (—at least 18° centigrade.)

1570, 1571. From the end of November 1570 to the end of February 1571, the winter was so severe that all the small rivers, even those of Languedoc and Provence were frozen so hard as to allow loaded carts to pass across them. (Meserai.)

1594. The sea was frozen at Marseilles and at Venice (—at least 20° centigrade.)

1603. Carts crossed the Rhone on the ice. (18° centigrade.)

1621, 1622. The Venetian fleet was hemmed in by the ice in the channels of Venice (—20°.)

1638. The galleys in the port of Marseilles were blocked in by the ice, —20° centigrade. (Papon, iv. 490.)

1655, 1656. The Seine was frozen across from the 8th to the 18th December. It froze afterwards from the 29th Dec. to the 28th January 1656, without interruption; in a few days after it once more commenced, and lasted till March. (Bouillaud).

1657, 1658. An uninterrupted frost at Paris, from the 24th December 1657 to the 8th February 1658. Between the 24th December and the 20th January, the frost was moderate; but after that the cold became intensely great. The Seine was entirely frozen. The thaw did not last long after the 8th February; the frost recommenced the 11th and lasted until the 18th.

It was in 1658 that Charles X. King of Sweden, crossed the Little Belt on the ice with his entire army, his artillery, his waggons, baggage, &c. &c.

1662, 1663. The frost lasted at Paris from the 5th Dec. 1662 to the 8th March 1663.

1676, 1677. A continued and intense frost from the 2d December to the 13th January. The Seine was frozen across during 35 successive days. (Boulliaud.)

1684. The Thames was frozen at London to eleven inches in depth, and was crossed over by loaded carts.

1709. The Gulf of Venice and the Mediterranean, at Genoa, at Marseilles, at Cette, &c. were frozen (—18° centigrade)

1716. The Thames was frozen at London; a great number of shops and stalls were established on the river.

1726. Persons crossed in sledges from Copenhagen to Sweden.

1740. The Thames at London was again entirely frozen.

From 1749 to 1781 the thermometer, in Provence, never fell below 9° centigrade. This period of 33 years having offered no instance of cold of 15° or 18°, as had been before observed, some persons immediately concluded that the climate was ameliorating; but in 1789 the illusion was destroyed, for on that year the cold at Marseilles was as low as —17° centigrade.

From 1800 to 1819 the thermometer was at no time below 9° centigrade in the department of the Bouches du Rhone; but in 1820, as in some of the remarkable years mentioned in the above list, the cold was so intense as —17° 5′ centigrade. Thus, whether we consider the intensity of the cold, or examine after what intervals the extraordinary colds are renewed, we can find no reason to admit, that within a period of 1400 years, the climate of Provence has undergone any notable alteration.

We shall now consider the climate of the capital, and shall in the first place determine to what degree the thermometer must fall in order to allow the Seine to be entirely frozen:

In 1740 the Seine was frozen; the therm. marked	14° cen.
1742	10° cen.
1744	9
1762	9
1766	9
1767	16
1776	12
1788	12 9′

From this table it appears, that it requires a cold of —9° centigrade, at least, for the river to be frozen at Paris. Thence, and from the observations of Boulliaud, we may conclude that in 1676 the *mean* temperature of the month of December must have been several degrees below the temperature of ice; in the present day the *mean* temperature of January is almost constantly positive.

For the last twenty years the mean temperature of January has not been below 1°. According to the observations given by Felibien, and those of Boulliaud, it was several degrees of centigrades below 0 in January, February, and March 1435; in January and February 1656; in January 1658; and in December, January, and February, 1662.

Should these observations not appear sufficiently numerous to enable us to draw from them the consequence that the winters at Paris were formerly more severe than in the present day, it must at least be allowed that they prove, contrary to an opinion very generally received, that the climate of Paris has by no means deteriorated.

MECHANICS' AND SCIENTIFIC INSTITUTIONS.

Carlisle Mechanics' Institution.—A lecture was lately given to the members of the Carlisle Mechanics' Institute, by one of their own body, on the "Utility of the Study of Chemistry and Philosophy in general." The lecturer pointed out the advantages which would result from the study of chemistry—a science of almost universal application, and earnestly recommended it to the attention of the society. The delivery occupied nearly two hours; but the subject-matter of the lecture itself might with propriety be considered an exordium to a course of lectures which is intended to follow. About fifty members were present; and the attention they paid to what was addressed to them clearly evinced the interest they took in it, and the benefit likely to accrue from such a system of instruction. The same evening, a handsome silver snuff-box was presented to Mr. D. Dunbar, the late secretary, who is about to leave Carlisle on a professional visit to the Continent. The box was the result of a voluntary subscription amongst a number of the members of the Institute, and bore the following inscription:—"Presented to Mr. David Dunbar, by the members of the Carlisle Mechanics' Institution, as a token of gratitude for his exertions in establishing the Institution."

Dover Mechanics' Institution.—A Mechanics' Institution is about to be formed at Dover. A numerous meeting of the inhabitants friendly to the measure has taken place for the purpose of forwarding this desirable object. In the course of the evening, letters from Dr. Birkbeck, W. Kingsford, Esq. of Buckland, and others, were read, stating their conviction of its utility; as was another from the Canterbury Philosophical Institution, offering every assistance in their power.

Honiton Mechanics' Reading Society.—There has been lately established at Honiton, a Tradesmen and Mechanics' Reading Society, which, though at present on a small scale, and not assuming to itself the title of a Mechanics' Institution, will introduce a general spirit of intellectual inquiry, and gradually tend to the improvement of its mechanical and labouring classes. The members have the use of a reading-room, with a small library furnished by the loan of the subscribers and well-wishers, which is open every evening from the hour of six till ten. In order to further the views of this establishment, and to afford to it some of the advantages attendant on more extensive institutions, the Rev. Joshua Bryan, of Honiton, kindly offered to deliver lectures there.

Scientific Institution at Diss.—A public meeting of the inhabitants of Diss and its neighbourhood was held last month at the King's Head Inn, in that town, for the purpose of establishing a Public Library and Scientific Institution. The chair was taken by the Rev. William Manning, and a number of resolutions were passed in furtherance of the object of the meeting. The names of shareholders and annual subscribers were then received; and notwithstanding that, owing to the inclemency of the weather, the meeting was small, in the space of a few minutes, upwards of £60 were paid into the hands of the Treasurer.

Hull Literary and Philosophical Society.—The second meeting of the Hull Literary and Philosophical Society was lately held, when a paper was read by Mr. T. J. Buckton "On the Origin of the Americans." The object of Mr. B. was to prove that the American tribes originally proceeded from the North-East of Asia. He founded this hypothesis chiefly on proofs derived from physiology and languages. He showed, from a number of independent authorities, that the varieties observable in the physiological characters of the American tribes are so inconsiderable, that no reasonable doubt can be entertained of their identity; and that the general character of the Americans strikingly indicates their close affinity to the Mongols, or to a mixture of the Mongols and Tartar races of the North-East of Asia. After observing that the American languages possessed great variety of inflections, and an intricate syntax, he concluded, that the American tribes are the remnants of one or more nations, who had attained a considerable degree of civilization; and he introduced a number of proofs of the extensive cultivation of the arts in the new continent. He produced comparative tables of American languages, and also of the Coptic, Japanese, Malay, Sanscrit, African, Basque, Celtic, and Caucasian, which he considered, however, too limited in the number of affinities to afford any satisfactory result. But he established the *identity* of the languages spoken by the Tshutshi in the North extremity of Asia, by the inhabitants of the North-west coast of America, and of the Aleutian islands, the Greenlanders, and the Esquimaux. He also showed that striking affinities subsist between the languages of the Samoyedes, the Tongoose, the Yakutes, the Calmucs, the Mantchoos, the Ainos of the Curile islands, the Ostracks, and the Tartars and Mongols generally, and also those of the various tribes of America, from Norton Sound and Greenland, through Mexico to Peru and Chili. He then alluded to the traditions of the American tribes, and to the Mexican histories; and concluded, that America was peopled from Asia, by wandering tribes of Mogul race, who passed thither by Behring's Straits, by the Aleutian Islands, and probably by some northern course, yet unknown to Europeans.

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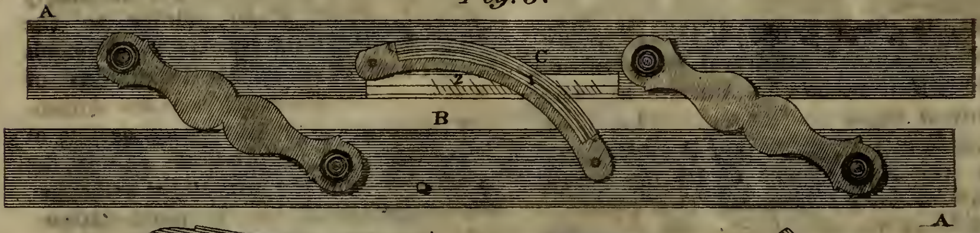
IMPROVED HOT-HOUSE STOVE; PARALLEL RULE; HALL'S ANGULOMETER.

Fig. 3.



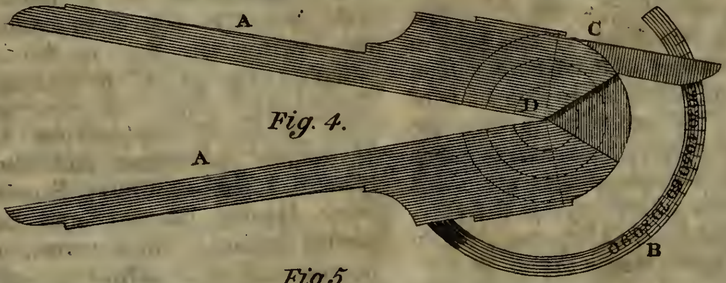


Fig. 4.

Fig. 5.

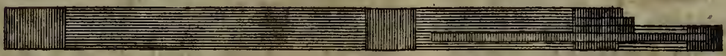


Fig. 6.

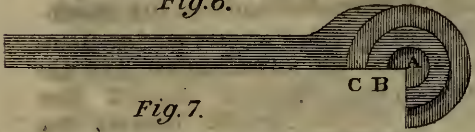


Fig. 7.

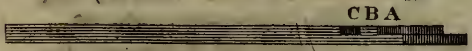


Fig. 8.

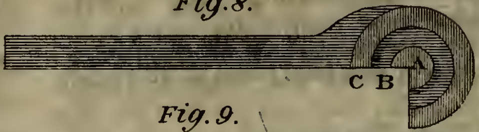


Fig. 9.

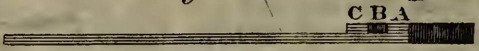


Fig. 2.

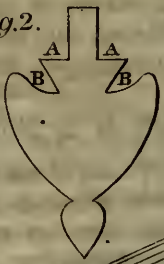
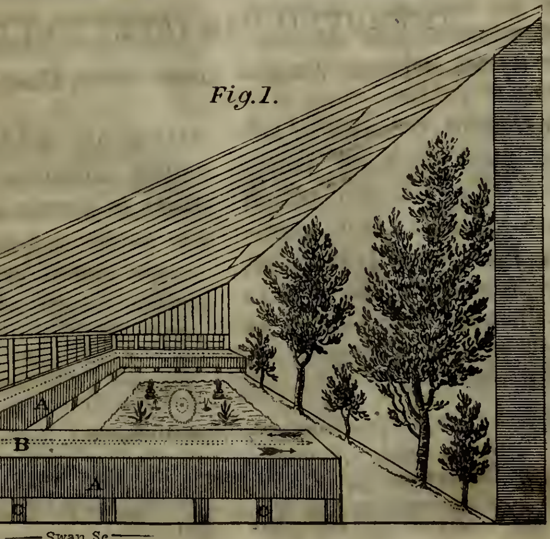


Fig. 1.



Swan. Sc.

PLAN OF A HOT-HOUSE STOVE.

Gentlemen,—I send you a plan of a hot-house stove which I have been in the custom of erecting here, and which may be useful to some of your readers who are florists.

The stove and flue are raised from the ground about eight inches, so that it radiates heat from the bottom as well as from the top and sides. There is a partition in the flue, which is shown by the dotted lines in fig. 1. The heat passes first along the one division of the flue, and then along the other, as is pointed out by the darts; and by this arrangement the heat is carried twice round the hot-house before it reaches the chimney. The top and bottom of the flue are flag-stones; the sides and partition are of brick. In order to heat the stove, I make a brisk fire about five o'clock in the afternoon, allowing it to burn till about eight o'clock, when I close the stove up in the following manner:—There is a slide in the chimney which prevents the further escape of the heat, and at the same time, the cold air from descending into the stove. A flag-stone is made to fit into the front of the fire-place, so that the iron doors are covered up by the flag. It is thus made completely air-tight, and is allowed to remain in this way all night; by which plan I have been enabled to keep up through the night a sufficient heat with regularity, and at moderate expense.

Description of the Engraving.

Fig. 1, A, the stove and flue; B, the partition; C, the curb-stone that supports the flue. Fig. 2 is the rafter on the roof; *a*, the rabat for the glass; *b*, the gutter to receive the water, if any, admitted between the wood and glass. This prevents the possibility of any drop falling on, or injuring the plants below. The gutter at the bottom of the rafter is made to receive the water, and convey it away. This plan might be advantageously used for sky-light windows.

Mathias Saul.

Lancaster, 7th Jan. 1826.

IMPROVED PARALLEL RULE.

By Mr. George Wood of Chapel-Street, Curtain-Road.

This improvement consists in adding a graduated scale of ivory, and a brass arc, by means of which the artist is enabled, at one operation, to set his parellel lines at certain and precise distances from each other—instead of trusting, as is too often the case, to the accuracy of his eye, rather than take the trouble of drawing a perpendicular, and dividing it by a scale of parts. The brass arc has the farther advantage of strengthening the instrument, which is a matter of some importance, particularly in rules of unusual length.

Description.

A, A, (fig. 3,) the rule; B, the scale of ivory divided into inches and $\frac{1}{12}$th parts; C, an arc of brass, the incidence of the outer edge of which, on any of the divisions of the ivory scale, determines the distance between any two parellel lines.

HALL'S ANGULOMETER, OR INSTRUMENT FOR MEASURING ANGLES.

Mr. Hall's angulometer has the peculiar advantage of opening from 1 to 90 degrees, without any part of the joint coming into the internal angle. Hence when any angle, solid or otherwise, has been measured by this instrument, it may immediately be transferred to paper, without any further operation, merely by drawing a pencil along the internal edge of the legs.

Description.

A, A, (fig. 4,) the legs; B, a graduated arc; C, the index; D, the point of the angle. Fig. 5, section of the above; figs. 6, 7, 8, 9, show the construction of the joint; *a*, *b*, *c*, wards working one on the other, and forming the joint.

THE VORTICES OF DESCARTES.

The vortices of Descartes are long justly exploded; but being the fiction of a very superior mind, they are still an object of curiosity, as being the foundation of a great philosophical romance. According to the author of that romance, the whole of infinite space was full of matter; for with him matter and extension were the same, and, consequently, there could be no void. This immensity of matter he supposed to be divided into an infinite number of very small cubes, all of which being whirled about upon their own centres, necessarily gave occasion to the production of two different elements. The first consisted of those angular parts which, having been necessarily rubbed off and grinded yet smaller by their mutual friction, constituted the most subtile and moveable part of the matter. The second consisted of those little globules that were formed by the rubbing off of the first. The interstices betwixt these globules of the second element were filled up by the particles of the first. But in the infinite collisions which must occur in an infinite space filled with matter, and all in motion, it must necessarily happen that many of the globules of the second element should be broken and grinded down into the first. The quantity of the first element having thus been increased beyond what was sufficient to fill up the interstices of the second, it must in many places have been heaped up together, without any mixture of the second along with it. Such, according to Descartes, was the original division of matter. Upon this infinitude of matter thus divided, a certain quantity of motion was originally impressed by the Creator of all things, and the laws of motion were so adjusted as always to preserve the same quantity in it, without increase and without diminution. Whatever motion was lost by one part of matter, was communicated to some other; and whatever was acquired by one part of matter was derived from some other; and thus, through an eternal revolution from rest to motion, and from motion to rest, in every part of the universe, the quantity of motion in the whole was always the same. But as there was no void, no one part of matter could be moved without thrusting some other out of its place, nor that without thrusting some other, and so on. To avoid an infinite progress, he supposed that the matter which any body pushed before it, rolled immediately backwards to supply the place of that matter which flowed in behind it; as we may observe in the swimming of a fish, that the water which it pushes before it immediately rolls backward to supply the place of what flows in behind it, and thus forms a small circle or vortex round the body of the fish. It was in the same manner that the motion originally impressed by the Creator upon the infinitude of matter necessarily produced in it an infinity of greater and smaller vortices, or circular streams; and the law of motion being so adjusted as always to preserve the same quantity of motion in the universe, those vortices either continued for ever, or, by their dissolution, gave birth to others of the same kind. There was thus, at all times, an infinite number of greater and smaller vortices, or circular streams, revolving in the universe.

But whatever moves in a circle is constantly endeavouring to fly off from the centre of its revolution. For the natural motion of all bodies is in a straight line. All the particles of matter in each of those greater vortices, were continually pressing from the centre to the circumference, with more or less force, according to the different degrees of their bulk and solidity. The larger and more solid globules of the second element forced themselves upwards to the circumference, while the smaller, more yielding, and more active particles of the first, which could flow even through the interstices of the second, were forced downwards to the centre. They were forced downwards to the centre notwithstanding their natural tendency was upwards to the circumference; for the same reason that a piece of wood, when plunged in water, is forced upwards to the surface, notwithstanding its natural tendency is downwards to the bottom; because its tendency downwards is less strong than that of the particles of water, which, if one may say so, press in before it, and thus force it upwards. But there being a greater quantity of the first element than what was necessary to fill up the interstices of the second, it was necessarily accumulated in the centre of each of these circular streams, and formed there the fiery and active substance of the sun. For, according to that philosopher, the solar systems were infinite in number, each fixed star being the centre of one; and he is among the first of the moderns who thus took away the boundaries of the universe. Even Copernicus and Kepler themselves, have confined it within what they supposed the vault of the firmament.

The centre of each vortex being thus occupied by the most active and moveable parts of matter, there was necessarily among them a more violent agitation than in any other part of the vortex, and this violent agitation of the centre cherished and supported the movement of the whole. But among the particles of the first element, which fill up the interstices of the second, there are many, which, from the pressure of the globules on all sides of them, necessarily receive an angular form, and thus constitute a third element of particles, less fit for motion than those of the other two. As the particles, however, of this third element were formed in the interstices of the second, they are necessarily smaller than those of the second are, along with those of the first, urged down towards the centre, where, when a number of them happen to take hold of one another, they form such spots upon the surface of the accumulated particles of the first element, as are often discovered by telescopes upon the face of that sun which enlightens and animates our particular system. Those spots are often broken and dispelled by the violent agitation of the particles of the first element, as has hitherto happily been the case with those which have been formed upon the face of our sun. Sometimes, however, they incrust the whole surface of that fire which is accumulated in the centre; and the communication betwixt the most active and the most inert parts of the vortex being thus interrupted, the rapidity of its motion immediately begins to languish, and can no longer defend it from being swallowed up and carried away by the superior violence of some other like circular stream; and in this manner, what was once a sun becomes a planet. Thus the time was, according to this system, when the moon was a body of the same kind with the sun, the fiery centre of a circular stream of ether, which flowed continually round her; but her face having been crusted over by a congeries of angular particles, the motion of this circular stream began to languish, and could no longer defend itself from being absorbed by the more violent vortex of the earth, which was then, too, a sun, and which chanced to be placed in its neighbourhood. The moon, therefore, became a planet, and revolved round the earth. In process of time, the same fortune which had thus befallen the moon, befel also the earth; its surface was incrusted by a gross and inactive substance; the motion of its vortex began to languish, and it was absorbed by the greater vortex of the sun. But though the vortex of the earth had thus become languid, it still had force enough to occasion both the diurnal revolution of the earth, and the monthly motion of the moon. For a small circular stream may easily be conceived as flowing round the body of the earth, at the same time that it is carried along by that great ocean of ether which is continually revolving round the sun, in the same manner as, in a great whirlpool of water, one may often see several small whirlpools, which revolve round centres of their own, and at the same time are carried round the centre of the great one.

Such was the cause of the original formation and consequent motions of the planetary system. When a solid body is turned round its centre, those parts of it which are nearest, and those which are remotest from the centre, complete their revolutions in one and the same time. But it is otherwise with the revolution of a fluid; the parts of it which are nearest the centre complete their revolutions in a shorter time than those which are remoter. The planets, all floating in that immense tide of ether which is continually setting in from west to east round the body of the sun, complete their revolutions in a longer or shorter time, according to their nearness or distance from him.

This bold system was eminently fitted to captivate the imagination, and, though fraught with contradictions and impossibilities, attempts have been made to revive it, even in this country, under different names. All those systems which represent the motions of the heavenly bodies as being the effect of the physical agency of ethers, of air, of fire, and of light, of which the universe is conceived to be full, labour under the same difficulties with the Cartesian hypothesis; and very few, if any, are so neatly put together. It is surely sufficient, however, to demolish this goodly fabric, barely to ask how an absolute infinity of matter can be divided into cubes, or any thing else? how there can possibly be interstices in a full plenum? or how, in such a plenum, any portion of matter can be thrust from its place?

MIGRATION OF BIRDS.

Dr. Schinz, secretary to the Provincial Society of Zurich, has endeavoured to discover the laws, according to which the birds of Europe are distributed over our Continent. The country in which the bird produces its young is considered as its proper one. The nearer we approach the Poles, the more do we find peculiar or stationary birds, and the fewer are the foreign species which make their appearance. Greenland has not a single bird of passage. Iceland has only one, which remains during winter, and leaves it in spring, for still more northern countries. Sweden and Norway have already more birds of passage, and we find them increasing in number, in proportion as we advance towards the centre of Europe. In the intertropical countries no bird emigrates; to the north they all emigrate. The propagation of birds keeps pace with the quantity of food. Spitzbergen has but a single herbivorous species; for the sea presents more nutriment, and all the rocks and cliffs are inhabited by aquatic birds. In the frigid zone, a much greater number of marsh birds breed than beyond the Arctic Circle and in the warm countries of Europe. Dr. Schinz also indicates the distribution of the species of domestic fowls; and remarks, that each country has its peculiar varieties of fowl.—*Bulletin Universel.*

OPENING OF THE SUSPENSION BRIDGE AT MENAI.

This stupendous structure was opened for general intercourse on Monday the 30th of January, at half-past one in the morning. As the season was considered unfavourable for a public celebration of the event, the Commissioners determined that the opening should be quite private; and in pursuance of this resolution, a meeting was held the previous evening at Bangor Ferry, to make the final arrangements.

Mr. W. A. Provis, the resident engineer, was then dispatched to meet the London (*via* Shrewsbury) down mail, and take charge of it across the bridge. Having mounted the box with the coachman, the mail proceeded, and on its way to the bridge took up as many as could either be crammed in, or find a place to hang by.

Thus loaded, amidst the blaze of lamps, the cheers of those assembled, and the roaring of a heavy gale of wind, the gates were thrown open, and the mail passed triumphantly across!

About nine o'clock, Sir H. Parnell, and the chief engineer, Mr. Telford, (whose magnificent works are his best eulogium,) passed over in the carriage of the latter. Throughout the remainder of the day the number of carriages, as well as horses and persons, that passed over was immense.

The extreme length of the chains from the fastenings in the rocks, is about 1600 feet. The height of the road-way from high-water line, is 100 feet. Each of the seven small piers, from high-water line to the spring of the arches, is 65 feet. The span of each arch is 50 feet. Each of the two suspending piers is 52 feet above the road. The road on the bridge consists of two carriage-ways (one way for going, and the other for returning) of 12 feet each, with a foot-path of 4 feet between these two carriage-ways. The carriage-roads pass through two arches, in the suspending piers, of the width of 9 feet, by 15 feet in height to the spring of the arches. To counteract the contraction and expansion of the iron, from the effect of the change of the atmosphere in winter and summer, rollers are placed under cast-iron saddles, on the tops of the suspending piers, where the chains rest. The vertical rods, an inch square, suspended from the chains, support the slippers for the flooring of the road-way, the roads being placed five feet from each other. The chains, 16 in number, contain 5 bars each; length of the bar, 9 feet 9 inches; width, 3 inches by 1 inch square, with six connecting lengths at each joint, 1 foot 6 inches, by 10 inches, and 1 inch square, secured by two bolts at each joint, each bolt weighing about 65 pounds, and the total number of bars, in the cross section of the chains, is 80.

The road-way consists (as we have stated) of two carriage-ways, each twelve feet in breadth, with a foot-path of four feet between them, so that the platform is about thirty feet in breadth.

The whole is suspended from four lines of iron cables by perpendicular iron rods, placed five feet apart, and these rods support the road-way framing. The suspending power is calculated at 2016 tons, and the weight to be suspended, exclusive of the cables, is 342 tons, leaving a disposable power of 1674 tons. The weight of the whole bridge between the points of suspension is 489 tons. It is calculated that the contraction and expansion of the iron cables may occasion a rise or fall to the extent of four or five inches; but the variations of the temperature of the atmosphere will not derange the bridge.

The abutments consist of masonry-work; four additional arches are on the Anglesea side; each of the two piers is 60 feet by 42½ wide at high-water mark, having a foundation of rock. These piers are connected with the whole of the remainder of the masonry, and form a mass constructed with blocks of hard lime-stone, of much greater weight than is necessary for supporting a bridge of this kind.

ON THE LEAVES USED BY THE CHINESE IN LINING TEA-CHESTS.

Much conjecture and doubt has existed respecting the plant which produces these leaves. Some have supposed them to belong to a scitamineous plant; while others, and with more reason, have regarded them as the leaflets of some species of palm with pinnated fronds. That they cannot belong to a scitamineous plant, is evident from the want of a midrib, from the disposition of the nerve, from their spinulously, serrated margin, and, lastly, from the harsher feel of both surfaces; and the equality of their sides clearly shows, that they are not portions of a compound leaf. Mr. Lambert obtained this summer a quantity of these leaves, for the purpose of comparing them with several broad-leaved *Gramineæ*, and we found them to approach so exceedingly near those of some species of *Pharus*, as scarcely to leave a doubt of the genus to which they ought to be referred. This new species may, therefore, should our conjecture prove correct, when the flowers are obtained, be named, *Pharus officinalis.—Edin. Phil. Jour.*

GLASGOW MECHANICS' INSTITUTION.

SUBJECTS FOR ESSAYS PROPOSED BY MR. DEUCHAR FOR THE STUDENTS ATTENDING HIS CLASSES.

[Continued from page 395 of the present Volume.]

22. The atmosphere presses with a weight of 15 pounds upon every square inch of surface, and the surface of our globe, taking it in even numbers, presents about 200,000,000 square miles. What, then, is the weight of the whole air that surrounds our globe?—Answer required by Saturday, 4th March.

23. Why does the air become colder as we ascend?

24. Why do a guinea and a feather, when in an exhausted jar, fall with the same rapidity to the bottom of it?

25. If we place, under a bell-jar-receiver, on an air-pump, a balance with an ounce of cork in the one scale, and an ounce of gold in the other, and exhaust the air, whether will the cork or the gold descend and appear heaviest, and why do they not continue to equi-poise each other?

26. How was the air first discovered to be a compound body?

27. What is the nature of combustion?

Solutions to several of the questions formerly proposed.

At the close of the lectures on the 14th and 15th February, Mr. Deuchar intimated that he had received some very ingenious answers to a number of the questions already given out, amongst which were solutions of twelve of the subjects by one gentleman; and it was but justice to the talent which had been shown, to state, that almost the whole papers given in were highly creditable to their respective authors. Mr. Deuchar then entered upon the explanation of some more of the questions, of which we now make an abstract.

To question 6, (page 264.)—In chemical action there is a change of nature produced, sometimes in form, colour, taste, smell, &c. and the character of the ingredients uniting are neutralized. But in mechanical action there is only a change of place.

To question 9, (page 296.)—A syphon, when full, and placed in two jars, makes these act as if they were one, and the pressure of the atmosphere at both ends keeps the syphon full: now, if we elevate the fluid in the one jar, we have the weight of that column of fluid to add to the pressure of the atmosphere; therefore the liquid flows through the tube into the lower vessel; and this goes on till the pressure is the same at both ends of the syphon.

To question 10, (page 296.)—The general results of chemical action are:—

a, A change of temperature.

b, A condensation in the ingredients.

c, A loss of the characters of the constituents.

d, The formation of a new compound, with new characters.

To question 11, (page 296.)—The lightness and heaviness of bodies depend upon gravitation; those are heaviest which contain most matter in a given bulk, and those are lightest which contain least.

To question 13, (page 296.)—We do not obtain a complete vacuum by means of the air-pump, for at the last motion of the piston of the pump we only withdraw a part of the air left in the jar; and however highly rarified that air may be, yet still, at the latest attempt we resort to, we can only divide what remains between the barrel of the pump and the jar.

ANDERSON'S INSTITUTION.

CLASS FOR FEMALES.

Gentlemen,—From the attention which is paid in the pages of your useful Magazine to the notices and reports of scientific institutions, more particularly to those for the instruction of mechanics, I am induced to request the insertion of the following remarks.

—The mechanics of Glasgow have had, for thirty years past, an opportunity of acquiring a knowledge of the arts and sciences at a moderate rate, and they have not failed to take advantage of that opportunity. Their character, their intelligence, and their progress in the arts, bear decided testimony to the usefulness of that Institution, where, for twenty-seven years, such instruction was alone to be obtained by them: and such has been its progress in this place, that the spirit of emulation has now spread over the whole kingdom, from the metropolis of the empire, to the almost obscure village, all vieing with each other in extending the benefits of science to their communities.

The Scots have been long celebrated for their intelligence, and this arises altogether from the wish which appears to be inherent in their nature, that their children should be instructed; and, except in remote places of the Highlands where such instruction cannot be got, there are few indeed of the inhabitants of Scotland who are unable both to read and write; and this elementary education is not confined to either sex, but both receive the same instruction; and from my own observation, I may venture, without fear of contradiction, to affirm, that, in general, the female sex make more rapid progress in these branches of elementary education than the other.—The cause is not difficult to discover: for boys are generally more fond of play than the girls, and, of course, less fond of their books. But here the superiority of the female sex, in general, ends; they have fewer opportunities afterwards of mixing with the world, or of extending their knowledge of it by the perusal of useful books; and they are therefore, with few exceptions, below the other sex in intelligence, when grown up to the prime of life. If, however, a taste for reading is acquired by a female, it is in general for such as is afforded by circulating libraries—chiefly novels and romances, which vitiate the mind to an alarming extent. It has, therefore, often occurred to me that something ought to be done in the way of affording opportunities to the female sex of acquiring at least a portion of that useful knowledge which is now so easily attainable by the other sex. Their importance to society is great: to females are left the task of forming the infant mind; and if, in this case, the teacher is untaught, what must be the state of those who are brought up under them? Early impressions are strong, and can scarcely be afterwards overcome; and it is therefore an object of the utmost importance to the interests of society that the first bias of the infant mind should be in favour of truth, not of error, which is too often the case. "Train up a child in the way he should go, and when he is old he will not depart from it," is the opinion of the wise man, and it would be indeed wisdom were it more understood and acted upon. Ignorance is the cause of much of the evil and crime which exists among us, and it would surely be a philanthropic work to adopt measures for its removal, of which female instruction ought to be the first.

Entertaining these views, it was with feelings of no ordinary kind that I heard Dr. Ure, on the evening of Saturday the 11th current, intimate to his pupils that he would open a class upon the Tuesdays and Fridays, in the evening, to which females would be admitted for so small a sum as five shillings, for the course of twenty or twenty-five lectures, entitling them also to the use of a large and increasing library.

This, Gentlemen, is another great step towards the accomplishment of the views of the benevolent founder of Mechanics' Institutions, Professor Anderson. Dr. Birkbeck and Dr. Ure have both assisted materially in promoting those views, and I trust that the example now shown will be speedily followed by other cities, as they have already done so much to extend the benefits of Professor Anderson's system of Popular Scientific Institutions.

Ever since the opening of Anderson's Institution in 1796, one of the classes has always been open to ladies, but as the fee was a guinea, it was only those in the higher ranks of life who could avail themselves of this opportunity; now, however, any one can have access for five shillings, a sum within the ability of all, and I trust the females of Glasgow will show that they know how to appreciate the opportunity thus afforded them.

I beg leave to subjoin the remarks of Professor Anderson regarding this part of his system, and from them your readers will see what were his views upon this important subject.

PHILO.

[We feel peculiarly indebted to our Correspondent for calling our attention to this subject, which is indeed one of very great importance. It is not to be doubted that the example afforded by the Andersonian Institution will be followed by the various institutions throughout the kingdom. The benefits which must follow require not to be farther pointed out than has been done in this letter. We are glad to be able to state, that, at the introductory lecture to this course, a large assemblage of females attended, who seemed to listen to the lecture of the learned Doctor with great decorum, and apparent pleasure.]

Extracts from Professor Anderson's Will.

"Article 9th.—1*st Rule.*—The Professor of Natural Philosophy, in this University, shall give Lectures, in the city of Glasgow, to be called "The Mathematical Course," every year, from the first day of November to the first day of May, according to the plan which I have long carried on in Glasgow College with great success: The Mondays, Wednesdays, Fridays, and Saturdays, being appropriated to the Mathematical part of Physics, without any experiments; and the Tuesdays and Thursdays being appropriated to the experimental part of Physics, without any Mathematics. The hours of lecturing and examination to be regulated by the Trustees, as well *as the honorarium or fee.*

"2*d Rule.*—Besides the above-mentioned Course of Physical Lectures, another Course shall likewise be given by the same Professor, at least once every year, to be called 'The Ladies' Course of Physical Lectures,' in which no Mathematical reasoning shall be used; and it shall be similar to the Course on the Tuesdays and Thursdays above-mentioned; but with this difference, that the audience shall consist of both *ladies and gentlemen. The time of the year, the days of the week, and the hours of the day, the honorarium, and every thing relating to it, shall be appointed by the Trustees, under the direction of the ordinary Managers.* The intention of this Course of Lectures is, that the ladies in Glasgow may have an opportunity, *for a small sum*, and in the early part of life, of being at several of these Courses of Lectures, by which their education for domestic affairs will not be interrupted. No pedantic language will be acquired, as is often the case in a more advanced age, and such a stock of general knowledge will be laid in as will make them the most accomplished ladies in Europe. Nor is this expecting too much, *as it is well known, that by the Course of Experiments which I have given annually, for many years, according to the plan in my Institutes of Physics, upon the Tuesdays and Thursdays, the* Manufacturers and Artificers *in Glasgow have become distinguished, in a high degree, for their general knowledge, as well as for their abilities and progress in their several arts.*

"4*th Rule.*—The ordinary Managers shall have a right to exclude from these Lectures, by the ballot, any person whatever, without giving any reason; that no men may be admitted who are disorderly, talkative, ill-bred, or intoxicated; and no women that are giddy or incorrect in their manners. If they do not like these conditions, they need not apply for tickets; for upon these conditions alone they can be received, and it is better that these nine ordinary Managers should sometimes be over severe, than that any disorderly persons, of either sex, should be admitted."

ON THE ANIMAL OF THE ARGONAUT.

The ancient celebrity of the Argonaut, which can be traced to Pliny and Aristotle, and the wonders of its navigation, are well known. It is also known, that, from the ancients down to ourselves, naturalists have been divided upon the subject of this animal. Some regarded it as a parasitic guest, which, like certain crustacea that lodge in empty shells, has possessed itself of that of the argonaut; others maintaining that the cephalopodous animal which is found in the shell is really its constructor and proprietor. All have agreed in considering the animal as a poulpe. M. de Blainville supported the former of these opinions. M. Ranzani has successfully combated M. de Blainville's arguments, and shows, that the question, so far from having been decided by him, still remains in the same state. A small, but very well preserved, specimen of this animal, sent to M. de Ferussac, by M. Risso of Nice, has enabled the former naturalist to examine its structure with minuteness. There results from the facts related by M. de Ferussac, that what has been said by the ancients on the subject of the argonaut, presents the degree of accuracy which we might expect to find in works that have come down to us only after having undergone more or less numerous alterations; nor could the authors of these works have applied to their writings the scrupulous accuracy to which the naturalists of the present times are accustomed. M. de Ferussac shows that the animal, when it is fresh, and has not been taken out of the shell, presents upon its mantle the exact form of this latter, and the impressions of the grooves and tubercles with which it is ornamented. The bad state of preservation of the individuals observed by M. Blainville, has without doubt been one of the causes of his error on the subject of the argonaut. M. de Ferussac then describes this animal in its state of contraction, when it has retired within its shell, and shows that it must belong to it, since its construction is entirely conformable to the organization of its inhabitant. He makes known an interesting fact which had hitherto remained unobserved, namely, that the spiral cavity, which is not filled by the extremity of the poulpe, is reserved for lodging the palmated part of the two great tentacula, which are united by this part into a small globular mass, forming a vault, under which the eggs find a place of protection, and perhaps also the heat necessary for their developement. These eggs are attached to the duplicatures of the palmated membranes, by small peduncles, and form altogether a cluster. M. de Ferussac proves, that it is really the constructor and the lawful proprietor of this beautiful shell. This opinion has long been adopted by Messrs. Cuvier and Dumeril, who were appointed by the Institute to examine M. de Ferussac's memoir—a memoir to which the Academy has accorded its approbation. M. Dumeril relates a fact which has escaped M. de Ferussac's notice, namely, that M. Duvernoy has long ago pointed out the existence of the shell upon the embryos in the eggs. Very lately an extract of a memoir of Poli on this animal, was read before the Royal Society of Naples. In this memoir, after a short introduction, he describes, in a circumstantial manner, its shell, and points out the varieties of it which occur. He then traces the history of this animal, indicates its mode of feeding, and describes its manner of sailing. He had an opportunity of observing at his ease, and in a state of life, an individual caught upon the shores of Pausilippe, which was sent to him by order of the King. He saw it lay its eggs, and observed the daily developement of the embryo of each of them, in which he found the shell already partially formed. M. Poli refutes the assertion of Aristotle, that the animal is not connected with its shell by any muscle. In a second memoir, this experienced naturalist intends to treat of the distinctive characters of the argonaut, and to give a full description of it. The two memoirs are accompanied with very beautiful plates.—*Bulletin Universel, May* 1825.

THE ALLIGATOR.

The following is an interesting description of this formidable and destructive animal, extracted from "An Historical and Descriptive Narrative of twenty years residence in South America," by Mr. Stevenson—a work of considerable merit, for the important and instructive information it conveys. He observes, that "he has frequently seen the alligators, or lagartos, eighteen and twenty feet long. They feed principally on fish, which they catch in the rivers, and proceed sometimes in company of ten or twelve to the mouths of the rivers and creeks, where two or three ascend while the tide is high, leaving the rest at the mouth; when the tide has fallen, one party besets the mouth of the creek, while the other swims down the stream, flapping their tails, and driving the fish into the very jaws of their devourers, which catch them and lift their heads out of the water to swallow them." The account which Mr. Stevenson gives of this extraordinary animal is in most respects in unison with, and corroborative of, what naturalists have previously written upon this subject. The same author further observes, that "when the lagarto has once tasted the flesh of animals it will almost abandon the fish, and reside principally on shore. I crossed the large plain of Babaoyo, where I saw a living one, buried, except the head, in the clay, beside the remains of several dead ones. On inquiring how they came there, the *montubios* (a name given here to the peasantry) told me, that when the rains fall in the mountains, great part of this savance is inundated, at which time the lagartos prowl about in search of the cattle remaining on the small islands that are then formed; and that when the waters retire they are left embedded in the clay, till the ensuing rains set them at liberty; they feed on flies, and can exist in this manner for six or seven months. When they are found in this state the natives always kill them, sometimes by piercing them with lances between the fore leg and the body, the only visible part in which they are vulnerable: if they are not prepared with a lance, they collect wood, and kindle a fire as near to the mouth of the lagarto as they dare venture, and burn him to death. These animals will sometimes seize human beings when bathing, and even take children from the shores; after having succeeded once or twice, they will venture to take men or women from the balsas, if they can surprise them when asleep; but they are remarkably timid, and any noise will drive them from their purpose. They have also been known to swim alongside of a small canoe, and suddenly place one of their paws on the edge and upset it, when they immediately seize their unwary victim. Whenever it is known that a *Cebado*, one that has devoured either a human being or cattle, is in the neighbourhood, all the people join in the common cause to destroy it; this they often effect by means of a noose of strong hide rope, baited with some animal food; when the lagarto seizes the bait its upper jaw becomes entangled with the rope, and the people immediately attack it with their lances, and generally kill it."

* * *

THE ANT AND THE BEE.

(Continued from page 384 of the present Volume.)

"The ant is an insect that keeps together in companies like the bee, maintaining a sort of republic, governed by laws. The nest is not exactly square, but longer one way than the other, and in it there are paths which lead to different magazines. Some of the ants are employed in making the ground firm, by mixing it with a sort of glue, for fear it should crumble, and fall down upon their heads. They may be sometimes seen to gather several twigs, which serve them for rafters, which they place over the paths to support the covering; they lay others across them, and upon them rushes, weeds, and dried grass, which they heap up into a double declivity, which serves to turn off the water from their magazines. Some of these are used for laying up their provisions, and in others they lay their eggs."

Of the manner in which the bees labour and store up their provisions we have the following description:—"From examining the bee singly, we now come to consider it in society, as an animal not only subject to laws, but active, vigilant, laborious, and disinterested. All its provisions are laid up for the community; and all its arts in building a cell, designed for the benefit of posterity. The substance with which bees build their cell is wax; which is fashioned into convenient apartments for themselves and their young. When they begin to work in their hives, they divide themselves into four companies, one of which roves in the fields in search of materials; another employs itself in laying out the bottom and partitions of their cells; a third is employed in making the inside smooth from the corners and angles; and the fourth company bring food for the rest, or relieve those who return with their respective burdens."

> ~~~~~~~~~~~~~~~"Hinc arte recentis
> Excudunt ceras, et mella tenacia fingunt."

How curious, how interesting are the manners, and in many respects the similarity in habit, of these different insects; and with what wisdom and harmony are the affairs of their little communities conducted!

There appears, however, to be this distinction observable between these insects in their forms of government, if we may make use of such language, the one being monarchical, and the other republican; for although the bees have their habitation, their food and provision, their labours, their cares of posterity, their sympathy of one another, and their courage and resolution to fight for one another, all in common; yet they appear to be under greater restraint, more regular and exact in the performance of their different services, than the ants—who make no hesitation, while at any time they may be on their march, proceeding upon the tidings of their spies, to attack a ripe pear, a cake of sugar, or a quantity of grain, to deviate individually from the track, and seize upon any chance prey they may happen to observe. Nevertheless, their expeditions are always seemingly executed with some kind of regularity; they are "ordered to assemble and move in the same track;" but "as they are a free people," and do not appear subject to any severe military discipline, so to speak, they make no scruple, as we have just observed, occasionally to overstep the bounds of regularity. That these insects, however, are each subject to, or at least observe, certian laws and regulations, is a matter past dispute. In every hive, it is universally allowed, there is a sovereign, though most naturalists are of opinion that this sovereign is a female. And the ant, though she hath no such "guide, overseer, or ruler," yet by an inherent wisdom, and the observance of certain regulations, she, to use the words of Solomon, "provideth her meat in the summer, and gathereth her food in the harvest."

(*To be continued.*)

MR. MILLAR'S STATEMENT OF CLAIMS, &c.

Gentlemen,—In addition to my former proof, I hope you will have the goodness to insert the following letters, which, with the evidence already published in Nos. XXIX. LXXXIV. and CX. of your Magazine, I flatter myself will convince every unprejudiced reader that I have made no further claims to the invention of Turkey-Red discharging, than I have fully substantiated.

John Millar.

Glasgow, Feb. 6th, 1826.

"Wellfield, 16th Dec. 1825.

"Sir,—We have read, with surprise, Mr. David Campbell's statement of claims to Turkey-Red discharging, published in the Glasgow Mechanics' Magazine—to which we must give our decided dissent. We have examined your small presses, made in 1802–1803, which are on the same principle as the first large cast-metal press made for you by Mr. John Roberton. The principle of the presses now at work here, is not altered since you invented them, and the cutting and forming those bandages, that Mr. Campbell knows nothing about, may be seen every day at this, or any other discharging work. The perfection you had brought your small presses to, before you mounted them on the large scale, is best known by the work they produce, and is such as we have never seen exceeded—more particularly the flower, which appeared in No. XXIX. of the Glasgow Mechanics' Magazine, which stands unrivalled, nor is it in the power of man to produce the least imitation of it from two plane surfaces. We are not ashamed to subscribe ourselves mechanics, as well as,

"Sir, your most obt. servants,

"Peter M'Farlane,
"John Bleckey.

"Mr. John Millar, Hill-Street, Glasgow."

"Glasgow, 18th Dec. 1825.

"Sir,—I have read Mr. David Campbell's statement of claims to Turkey-Red discharging, published in No. LXXXIX. of the Glasgow Mechanics' Magazine, and am sorry that any gentleman should obtrude so much misrepresentation on the public, which can have no means of deciding the controversy, but by the evidence adduced. I have seen your original models, or small presses, mounted with lead and brass bandages, made in 1802–1803, and which differ nothing in principle from the presses in use at this day. The application of Tennant's salt, the bandages, and the cast-metal presses are now allowed, beyond a doubt, to be your own invention; and Mr. Campbell's ignorance of what a bandage is, operates more powerfully to prove his ignorance of the business, than any argument possibly could do. I am generally acquainted in the trade, but, upon inquiry, cannot find that any print-cutter or engraver ever was employed by Blantyre Co., previous to their coming to Barrowfield. Why Mr. C. should carp at the evidence of a mechanic, or a labourer, merely because they are such, he alone must determine; I feel confident, however, the immortal Watt would not have done so.—Fully concious that I understand my own meaning,

"I am, Sir,

"Your most obedient servant,

"William Keith.

"Mr. John Millar, Hill-Street, Glasgow."

MISCELLANIES.

Botanic Gardens in Ireland.—There are three botanic gardens in Ireland; two in Dublin, the other in Cork. The last-mentioned is small in extent, and the collection of plants few, comparatively speaking. Of the two in Dublin, one belongs to the Dublin Society, the other to Trinity College. The former is the largest in the empire, and, in point of picturesque beauty, is wholly unequalled. The botanic gardens in Dublin possess this advantage over those in Britain, namely, a classical arrangement of trees and shrubs. It is an extraordinary circumstance, says Mr. Loudon, the great attention paid in the British botanic gardens to the collecting and arranging of herbaceous plants, while the greater part of trees and shrubs have been, till of late, neglected. The Dublin Society's garden is open to the public. A course of lectures is delivered annually, which is also free, and even the young men employed in the garden are obliged to attend. This garden was not laid out and managed by the late Dr. Wade, the professor of botany, as was generally supposed, but by the present superintendent, Mr. W. Underwood. Mr. Mackay, the curator of the college garden, is so well known as an indefatigable botanist, that any observation here regarding him would be quite superfluous. All these botanic gardens are ably described in the Edinburgh and Gardening Encyclopædias.

Newcastle and Carlisle Rail-Road.—The directors of the proposed rail-road from Newcastle to Carlisle have printed a detailed report of the intended line on which they have finally agreed that it shall be laid down. It is to commence at the High Crane, on Newcastle Quay, pass behind the abutment, and under the roadway of Newcastle bridge, and thence upon geers to the further side of the Javel Group, where it will enter upon a new quay to be erected in a direct line to the wharf of Messrs. Parker and Co. at Low Elswick. It will be carried thence along the banks of the river above the flood marks, to Scotchwood, and will cross the Tyne at the Northumberland paper-mill. It is to be continued on the south side of the river to Tyne Green, where it will again cross it, and proceed by Brampton to Carlisle. The length is reduced from sixty-four and a half to sixty-one miles. There are to be seven branches from the main road. Only one cottage will be removed. There will be no inclined planes, nor stationary engines; and the whole labour upon it will be performed by horses, the directors having resolved to introduce a clause into the bill, to prohibit the use of locomotive engines, in consideration of the prejudice of the land-owners against these machines.

Cause of the great rise of the Tide in the Bristol Channel.—Mr. Wallis, in a lecture given lately at the Western Literary and Scientific Institution at Bath, remarked that "the great rise of the tide in the Bristol Channel and the Severn was obviously caused by the projecting land of Devonshire and Cornwall. Sometimes the tide comes in as if it were one immense wave of six or eight feet in height; and it rises in the river Avon at Bristol nearly forty feet. These sudden swells have often occasioned great damage."

Silk Trade at Taunton.—The number of silk-looms in this town amounts to about 1000, and 200 in the vicinity. Each loom is computed to give employment to two persons, so that the warpers, winders, quillers, and weavers, including those persons employed in the throwing mills, in the manufacture of Organzine silk, amount to not fewer than 2500 persons. The annual returns of the silk trade in Taunton may be estimated at not less than £150,000. The wages alone are about £1000 per week. The trade is at present in so prosperous a state, that nothing but the want of suitable houses for the artizans employed prevents it from being doubled.

The use of the Microscope.—When Swammerdam died, and no one found himself equal to succeed him, a report was raised that his microscope was of a peculiar kind, and the mode of using it was thus lost at his death; so it is at present with Bauer. Many applications are made to the mathematical instrument makers for a Bauer's microscope, by those who are not willing to believe it is their own inability and not the fault of the microscope, that prevents their arriving at his excellence in observation.

Stockton and Darlington Railway.—Since the opening of the Stockton and Darlington rail-road from the pits to the former place, coals have been reduced from one-third to one-half in price; the Company have not been able to supply many of the carts; and they have been compelled to go by the usual way to the pits. Nearly the whole of the work is done by the locomotive steam-engine, which goes at the rate of seven or eight miles an hour, with sixty tons of coals attached to it.

☞ This Number finishes the present Volume. The Supplementary Number will be embellished with a very splendid portrait of Joseph Hume, Esquire, M. P., engraved by a first-rate London artist, from a painting taken for the purpose; and will contain a Memoir of Mr. Hume, written expressly for the Work. We are obliged to delay the publication of this Number, however, for a few days, owing to the Plate not having yet arrived from London. The Index and List of Plates will be given with the Supplementary Number.

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